Senior 4 Applied Mathematics (40S)
Standards Test

Administration Manual
for Supervising Teachers

January 2004

Manitoba
Building for the Future

Copyright © 2003, the Crown in Right of Manitoba,
as represented by the Minister of Education, Citizenship and Youth.
Manitoba Education, Citizenship and Youth,
Assessment and Evaluation Branch,
Winnipeg, Manitoba R3E 3J5

Permission is hereby given by the copyright owner to reproduce this document on a non-profit basis for educational purposes provided the source is mentioned.

Preface

This *Administration Manual for Supervising Teachers* is distributed to teachers and administrators, and must be read prior to administering the standards test. The rules and guidelines in this manual must be strictly observed to ensure the consistency of standards test administration.

Please use this manual in conjunction with the registration package, the *Policies and Procedures for Standards Tests* handbook and the *Information Bulletin* (these documents are available on our website at: http://www.edu.gov.mb.ca/ks4/assess/publications.html) to gain a full understanding of the protocols and procedures associated with this test. This manual contains general information about the test, step-by-step instructions for each day of the test administration, and policies regarding absenteeism, lateness, violation of rules, etc.

If you encounter exceptional circumstances not addressed in this manual, or if you have further inquiries, contact Carol Chabbert, Administrative Officer, at 945-0747 or toll-free at 1 800 282-8069, extension 0747.

Table of Contents

Page

General Information 1
  Features of the test 2
  Test schedule 3
Policies for Standards Tests 3
  Adaptations 3
  Exemptions 4
  Re-read provisions 4
  Return of tests to students 4
  Test confidentiality 4
  Student materials 5
  Students leaving the room 5
  Late arrivals 6
  Student absences 6
  Responding to student questions 6
  Violation of rules 6
  Damaged or misprinted materials 7
    On test administration date 7
    During test administration 7
Responsibilities of School Principals 8
Responsibilities of Supervising Teachers 9
    Advance preparations 9
    Prior to test session 10
    Beginning the test session 11
    During the test session 12
    Ending the test session 12
  Submitting materials 15
    Centralized marking (scored at a central location) 15
    School-based and classroom-based marking (scored by classroom teacher) 16

Appendices 19
Appendix 1: Inquiry Task Session Rules 21
Appendix 2: Written Test Session Rules 22
Appendix 3: Sample Pre-printed Demographic Data Form 23
Appendix 4: Sample Generic Demographic Data Form 24
Appendix 5: Sample Attendance Form 25
Appendix 6: List of Reason Codes to Record Changes in Standards Test Student Registration Numbers 26

General Information

Manitoba Education, Citizenship and Youth develops all standards tests in collaboration with teachers from across the province. This standards test is based on the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards (2001)*.

The standards test is locally marked and counts for 30% of each student's final grade in the course. Student results on the test will be released to students according to local policy on the date designated by local jurisdictions.

All students enrolled in Senior 4 Applied Mathematics (40S), except those who have been exempted, must write the Senior 4 Applied Mathematics (40S) Standards Test on January 21 and 22, 2004. However, a student may rewrite a mandatory provincial standards test at any regularly scheduled administration without being registered in the course (see *Policies and Procedures for Standards Tests*, Section 3.1).

Marking instructions are provided by the department immediately following test administration. School principals will receive the *Marking Guides* for the Senior 4 Applied Mathematics (40S) Standards Test by January 22, 2004. The *Marking Guides* are to be stored in a secure location until 12:30 p.m. on January 22, 2004.

Students are expected to write the standards test as scheduled near the end of the semester in which they take the course (e.g., January for first-semester courses, June for second-semester and full-year courses).

All schools should receive the test materials by January 12, 2004. Principals of public schools receive test materials from their division/district offices. Principals of independent and band-operated schools will receive test materials directly from the Assessment and Evaluation Branch.

The number of test booklets sent to each school is based on the October 3, 2003 registration information provided by the school. Please advise Carol Chabbert, Administrative Officer, at 945-0747 or toll-free at 1 800 282-8069, extension 0747, immediately if the number of students registered to write the test has increased since registration.

Manitoba Education, Citizenship and Youth supports local marking by:

- training representatives from local jurisdictions to act as local marking co-ordinators;
- collecting and scanning all *Answer/Scoring Sheets* (for the Written Test) and *Recording Sheets* (for the Inquiry Task) from jurisdictions to provide them with test result summaries;
- centrally marking a random sample of locally-marked test booklets to provide feedback to jurisdictions on their local marking; and

- providing provincially-funded local jurisdictions with $10.00 for each test administered in accordance with the test schedule noted on the following page and marked locally. The calculation is based on the number of students whose completed marking scan sheets have been received.

Features of the test

- The test is comprised of two components: an Inquiry Task and a Written Test.
- English or French versions of the test are available.
- Students will be allowed to use an 8½ × 11 individually prepared study sheet during the Inquiry Task and the Written Test.
- The Inquiry Task component consists of items targeting two curriculum units of the *Senior 4 Applied Mathematics: A Foundation for Implementation (2000)*. The Test Development Committee considered the inclusion of a new Inquiry Task this year. However, to prepare a quality Inquiry Task and to ensure that all Senior 4 Applied Mathematics teachers are adequately informed, this decision has been postponed one year. A new Inquiry Task will be introduced in the 2004–2005 school year. This school year for both semesters, the two units assessed by the Inquiry Task are Personal Finance and Design and Measurement.
- The Written Test will assess the remaining six curriculum units and will not include items from the two units already assessed by the Inquiry Task.
- The Inquiry Task comprises 25% and the Written Test 75% of the total marks of the standards test.
- The Inquiry Task requires the use of technology such as computer software and/or a graphing calculator.
- The Written Test requires the use of a graphing calculator. Students may use computer software, depending on the tools normally used in the classroom for instruction, as well as the Internet.
- The main characteristic of the Inquiry Task is the investigative nature of the items that require some reflection on the part of the student for problem solving. The Inquiry Task will consist only of constructed-response items that may range from restricted-response, restricted-response with explanation to open-response items.
- The Written Test will consist of multiple-choice items as well as constructed-response items.
- Strict administrative procedures, as detailed in this manual, need to be followed by the classroom teacher to avoid any compromise to the integrity of the test.

Test schedule

The following table summarizes the schedule for the Senior 4 Applied Mathematics (40S) Standards Test:

Date	Session	Preparation Time	Activity	Time Required for Test
Wednesday, January 21, 2004	1	15 minutes preparation and instructions	Inquiry Task	2 hours
Thursday, January 22, 2004	2	15 minutes preparation and instructions	Written Test	2.5 hours

The test must be written between 8:30 a.m. and 12:30 p.m. on Wednesday, January 21, 2004 and Thursday, January 22, 2004.

The total writing time is 2 hours for the Inquiry Task and 2.5 hours for the Written Test plus 15 minutes for preparations and instructions before each test session.

Policies for Standards Tests

Principals and supervising teachers should be aware that *Policies and Procedures for Standards Tests* handbook has been distributed to all schools and is also available on our website at: http://www.edu.gov.mb.ca/ks4/assess/publications.html. This handbook outlines current policies and procedures related to the administration of standards tests and reflects the principles and guidelines contained in *Principles for Fair Student Assessment Practices for Education in Canada (1993)*.

Adaptations

Schools are asked to identify and submit requests for test adaptations **at the time of student registration**. These requests should be submitted on the *Request for Adaptations Form* included with the registration package. Following departmental review of the adaptation requests received, schools will be advised of the department's decision regarding these requests (see *Policies and Procedures for Standards Tests*, Sections 4.0, 4.1 and 4.2).

Exemptions

Decisions for student exemptions that fall within the guidelines set out in *Policies and Procedures for Standards Tests* (Sections 5.0, 5.1 and 5.2) are made at the school level and do not require departmental approval. Schools are required, however, to report school-based exemptions on the *Student Exemption Report* included with the registration package. If additional student exemptions are needed after the registration deadline date, an additional *Student Exemption Report* should be submitted as soon as possible.

For exemptions that fall outside the parameters of policy and procedure guidelines, requests should be made **at the time of student registration**. Please submit requests in writing to Wenda Dickens, Acting Director, Assessment and Evaluation Branch, 71–1567 Dublin Avenue, Winnipeg, Manitoba R3E 3J5.

Re-read provisions

As the reporting of individual student scores on locally marked standards tests is the responsibility of each local jurisdiction, the re-read policy for these tests is determined locally. Should a re-read be required for a test booklet that has been sent to the department as a part of the feedback on the marking process, the department will return a photocopy of the test booklet upon request. Please contact Carol Chabbert, Administrative Officer, at 945-0747 or toll-free at 1 800 282-8069, extension 0747.

Return of tests to students

Local jurisdictions decide whether to keep the test booklets or return them to students. The department will return the random sample of test booklets to schools within three months of marking.

Test confidentiality

Test materials must be kept secure and sealed until administration.

After each session, all materials are returned for safe-keeping to the secure area.

Test booklets must not be reproduced nor information from them communicated in any way until test administration is completed.

The *Marking Guides* are to be stored in a secure location until the test administration is complete.

Student materials

Students may use the following materials during the Senior 4 Applied Mathematics (40S) Standards Test:

- HB pencil;
- eraser;
- ruler;
- protractor;
- extra piece of 8½ × 11 blank paper and/or 0.5 cm graphing paper provided by the classroom teacher during the test sessions upon request;
- graphing calculator;
- computer software for either or both the Written Test and Inquiry Task; and
- and 8½ ×11 individually prepared study sheet. NEW!

Students are not permitted to exchange materials during the test.

Access to Internet tools employed in the everyday Applied Mathematics (40S) class is allowed during the test. The same measure applies to student developed templates such as spreadsheets. Programs downloaded to the TI–83 calculator during the school year are allowed for use during the test. NEW!

Please note that students may choose to print their responses from the computer. In such cases, students are to indicate their booklet ID number on each page and remain seated at all times. You are responsible for distributing the printouts to them according to booklet ID number, so they can staple them appropriately to their booklets.

The following materials must **not** be used during the test:

- textbooks and other printed documents;
- subject-related materials on display; and
- dictionaries or translation resources of any kind.

Students leaving the room

Students are expected to remain in the room for a minimum of 60 minutes from the start of each test session.

Any student who must leave and re-enter the room should be accompanied by a replacement supervisor. This practice ensures that the supervising teacher can remain in the test room with the students at all times.

Late arrivals

Students who arrive more than one hour after the test has started will not be allowed to write the test. Students who arrive late but within the first hour of the test will be allowed to write. In this case, the student will be allowed additional time corresponding to the amount of time by which the student was late.

Student absences

Standards tests cannot be written at a later date. In the event that a student writes the standards test after the official test date, the mark obtained cannot be reported as a standards test result. Therefore, schools have the responsibility to provide a final mark to absent students. The final mark for these students must be identified as a school-based assessment and evaluation practice only (see *Policies and Procedures for Standards Tests,* Sections 6.0, 6.1 and 6.2, for additional information).

Responding to student questions

Avoid making any directing/guiding comments during the test, other than those required for distribution of materials and instructions to students.

No explanations, translations, rephrasing, clarifying statements or comments of a similar nature may be provided about the test content. Supervising teachers can, however, provide clarification regarding test taking rules or procedures.

If a student asks a question related to test content, a suggested response is, “I'm sorry. I can't answer your question. Do your best with it.”

Suspected errors in printing or wording should not be communicated to students unless specific instructions are received from the Assessment and Evaluation Branch. You may however contact Philippe Le Dorze, Assessment Consultant, at 945-0670 or toll-free at 1 800 282-8069, extension 0670 to report any suspected errors.

Violation of rules

The *Inquiry Task Session Rules* or the *Written Test Session Rules* are read aloud to students by the supervising teacher immediately before each session of the test (see Appendices 1 and 2, pages 21 and 22).

Document any violation of rules on the *Supervising Teacher Report*. This documentation should include:

- the test booklet number; and
- a description of the circumstances, including available evidence.

The student may be permitted to complete the test.

The consequences of any violation of rules is a local decision.

Damaged or misprinted materials

Students should be assured that they will not be penalized for any obvious error in printing or wording. Local marking co-ordinators will be advised of any known errors before the marking session. Return the unused damaged or misprinted booklet(s) with the reports and forms being sent to the department immediately after the final test session.

On test administration date

If a damaged or misprinted test booklet is discovered **at the start** of the test session:

- replace the damaged or misprinted test booklet with a new test booklet; and
- print "DAMAGED" on the test booklet cover and on the *Attendance Form.*

During test administration

If a damaged or misprinted test booklet is discovered **during** the writing of the test:

- give the student a new test booklet (the student keeps the damaged or misprinted test booklet until the end of the session);
- instruct the student to continue responding to test items in the new test booklet;
- collect both test booklets at the end of the test session and ensure that both booklets are kept together by bundling with an elastic band;
- cross out the existing booklet number on the new test booklet and change it to the original booklet number so that **all student responses are recorded under the original booklet number**;
- indicate on the *Attendance Form* that two booklets have been used for one student (see Appendix 5, page 25); and
- record the damaged or misprinted test booklet number on the *Supervising Teacher Report.*

Responsibilities of School Principals

It is the responsibility of the principals to ensure that the tests are kept confidential until test administration is completed.

Other responsibilities are listed below.

If tests are not in your school by January 12, 2004:

- public school principals should contact their superintendent; and
- principals of independent and band-operated schools should contact Carol Chabbert, Administrative Officer, at 945-0747 or toll-free at 1 800 282-8069, extension 0747.

Use the *Packing List* to confirm that all materials have been received. Count the shrink-wrapped test booklets to ensure that there are enough booklets for the number of students writing the test. Keep the shrink-wrapped test packages unopened until the morning of the test. If additional test materials are needed, immediately contact Carol Chabbert, Administrative Officer.

Please note that the shrink-wrapped test bundles are divided into two packages. The Inquiry Task package should be opened on January 21, 2004, in preparation for the beginning of the Inquiry Task session.

The Written Test package should remain unopened in a secure location until the morning of January 22, 2004, at which time the Written Test will be administered.

Store test materials in a secure area in the school.

Provide supervising teachers with a listing of MET numbers for the students registered to write the test. Call the Professional Certification and Student Records Unit at 1 800 667-2378 to obtain MET numbers for new students.

Make arrangements to meet the requirements of the adaptations approved for your students (see Adaptations, page 3 and *Policies and Procedures for Standards Tests*, Sections 4.0, 4.1 and 4.2).

Co-ordinate test scheduling and space requirements.

Minimize the frequency of school announcements during the test sessions.

Ensure that a replacement supervisor is available to accompany students who must temporarily leave the room.

Provide the test materials to the supervising teacher on each morning of the test.

Complete the *Principal Feedback Form* before the end of the final test session.

Advise the Assessment and Evaluation Branch of school closures or suspended school bus transportation services that occur on the test dates as a result of unusual or extenuating circumstances or inclement weather conditions. Please contact Philippe Le Dorze, Assessment Consultant, at 945-0670 or toll-free at 1 800 282-8069, extension 0670.

Responsibilities of Supervising Teachers

Supervising teachers administer the test using the step-by-step procedures outlined in the following section.

(✓)	**Advance preparations**
	1. Check with your principal to ensure that:
	– appropriate scheduling and allocation of space for the test has occurred;
	– the test materials itemized on the *Packing List* have been inventoried;
	– a replacement supervisor is available to accompany students who must temporarily leave the room during the test;
	– arrangements have been made to accommodate the adaptations approved for students; and
	– a list of MET numbers for students writing the test is available.
	2. Ensure that all subject-related materials have been removed from the walls and boards.
	3. Notify students in advance of the:
	– time, location and duration of each test session;
	– materials needed to write the test (including the individually prepared study sheet);
	– *Inquiry Task Session Rules* and the *Written Test Session Rules* (see Appendices 1 and 2, pages 21 and 22); and
	– minimum time a student must remain in the test room (60 minutes).
	4. Ensure that you have extra supplies and that there is a functioning pencil sharpener and stapler in the room. Students must not exchange materials during the test. If students print their responses from the computer, they should remain seated. Distribute the printouts to them according to booklet ID numbers identified on each page of the printout.
	5. If there is more than one teacher supervising the test, photocopy the *Supervising Teacher Report*.
	6. Review the sample forms in the Appendices.
	7. Please note that the pre-printed *Demographic Data Forms* already have the students' names and MET numbers and should be distributed accordingly.

NEW!

Note: Shaded areas indicate the step is not applicable.

Session 1	Session 2	
(✓)		**Prior to test session**
		1. Ensure that you have access to the following test materials:
		– *Packing List*;
	▨	– *Inquiry Task* booklets;
▨		– *Written Test* booklets;
		– *Attendance Forms* (enclosed with shrink-wrapped test booklets);
		– *Student Registration Update Form*;
	▨	– four extra copies of *Inquiry Task* booklets;
▨		– four extra copies of *Written Test* booklets;
		– *Demographic Data Forms* (pre-printed and generic);
		– a list of MET numbers for students writing the test;
▨		– *Answer/Scoring Sheets* (for the Written Test);
	▨	– *Recording Sheets* (for recording marks for the Inquiry Task) (Keep in a secure location and forward to marking site (if applicable) with test materials on January 22, 2004);
		– *Supervising Teacher Report*;
		– *Supervising Teacher Feedback Form*;
		– *Principal Feedback Form* (this must be given to the principal and collected before returning materials);
		– *Administration Manual for Supervising Teachers* (this document);
		– envelope labelled "For the Return of Study Sheets"; and
		– labelled envelope for the return of materials to the Assessment and Evaluation Branch.
		2. Count the number of *Inquiry Task* booklets (Session 1) and *Written Test* booklets (Session 2). The number of test booklets should equal the number requested by the school plus the additional 4 booklets. If you need to split a bundle of booklets between classrooms, make a photocopy of the *Attendance Form*. Adjust each copy of the *Attendance Form* to reflect the booklets being used in each classroom.
		3. Arrange the desks so they are spaced as far apart as possible.

Note: Shaded areas indicate the step is not applicable.

Session 1	Session 2	
		4. Remove the following from the envelope labelled "For the Return of Demographic Data Forms":
		– pre-printed *Demographic Data Forms* in alphabetical order for every student registered to write the test. Ensure that the school name, school code, and MET numbers appearing on the pre-printed forms are accurate (see Appendix 3, page 23); and **NEW!**
		– generic *Demographic Data Forms* for students who joined the classroom after registration, and who are scheduled to write the test (see Appendix 4, page 24). **Note:** Only **one** *Demographic Data Form* should be completed for each student. If a pre-printed *Demographic Data Form* exists for a student, that is the form that should be used. **DO NOT** complete a generic *Demographic Data Form* for that student.
		5. Sort the pre-printed *Demographic Data Forms* for distribution.
		6. Make arrangements per school policy to ensure that students who are exempted from writing the test are accommodated in an alternate setting.
(✓)		**Beginning the test session**
		1. Distribute:
	▨	– *Inquiry Task* booklets;
▨		– *Written Test* booklets;
▨		– *Answer/Scoring Sheets*;
		– *Demographic Data Forms* (as needed in Session 2); and
▨		– the individually prepared study sheets.
▨		2. Remind students to check that the number on the *Answer/Scoring Sheet* corresponds to the number on their *Written Test* booklet.
		3. Instruct students to write their booklet number in the upper right-hand corner on their study sheet.
		4. Tell students that while they are working you will:
	▨	– be circulating the *Attendance Form* so they can print their names beside their test booklet number; and
	▨	– write the time and location of the next test session on the board.
▨		5. Ensure that each student receives the correct test booklet by verifying that the test booklet number corresponds to the student name recorded on the *Attendance Form*.
	▨	6. Read aloud instructions for completing *Demographic Data Forms*. The instructions are found on the form itself. Direct students to print and shade in all the information requested. Remind students to accurately record the program (English, French Immersion, or Français) in which they are enrolled.
		7. Collect the *Demographic Data Forms* (as needed in Session 2).

Note: Shaded areas indicate the step is not applicable.

Session 1	Session 2	
	▨	8. Read aloud *Inquiry Task Session Rules* (Appendix 1, page 21) to students.
▨		9. Read aloud *Written Test Session Rules* (Appendix 2, page 22) to students.
	▨	10. Read aloud "Description" and "Test Resources and Directions" from *Inquiry Task* booklet to students (page 3 in test booklet).
▨		11. Read aloud "Description" and "Test Resources and Directions" from *Written Test* booklet to students (inside cover in test booklet as well as the directions on page 9).
		12. Remind students to:
		– pace themselves in writing the test;
▨		– use the *Answer/Scoring Sheet* for responding to selected-response questions; and
		– check over their work to ensure that all questions have been attempted.
		13. **Instruct students to turn the page and begin. Record the start time on the *Supervising Teacher Report*.**
(✓)		**During the test session**
		1. Supervise the completion of the *Attendance Form* by ensuring that students print their name beside their test booklet number. Under "Student Attendance During Test Sessions", record a "✓" for present. The names of absent students should be written on the *Attendance Form* so that these students will have a booklet number for the next session of the test. Indicate that the student is absent by recording an "A" on the *Attendance Form* (see sample *Attendance Form*, Appendix 5, page 25). **Note:** This is the only record connecting students' identities to their *Inquiry Task* and *Written Test* booklets.
▨		2. Ensure that each student absent for the first test session completes a *Demographic Data Form*.
		3. Verify that all the information on each *Demographic Data Form* is accurately printed and shaded. Place all used forms in numerical order followed by any unused forms in the labelled envelope provided. Do not use elastic bands, staples or paper clips on these forms as they may damage the sheets. Do not seal the envelope.
		4. Half-way through the test session, advise students of the amount of time remaining by writing it on the board.
(✓)		**Ending the test session**
		1. Have students place their *Answer/Scoring Sheet* (session 2 only) and/or their individually prepared study sheet inside the front cover of the test booklet.
		2. Collect the test booklet from each student. Extra paper printed out or used by a student must be stapled in the booklet at the appropriate page (or onto the back page if used for miscellaneous calculations).

Note: Shaded areas indicate the step is not applicable.

Session 1	Session 2	
		3. As students submit their test materials, ensure that each test booklet number matches the information on the *Answer/Scoring Sheet*, the *Attendance Form* and the study sheet (e.g., cross-reference student name and test booklet number). Each student must have the same booklet number on all test materials.
		4. Place a check "✓" on the *Attendance Form* in the "Booklets Submitted to LMC for Marking" column.
		5. **Record the time students finish writing the test on the *Supervising Teacher Report*.** Do not include extra time given for late arrivals or adaptations.
		6. Remove the study sheets from the test booklets, sort them numerically by booklet number and place them in the envelope labelled "For the Return of Study Sheets". Do not seal the envelope.
		7. Stack the test booklets in numerical order.
▨		8. If marking is conducted in the classroom or at the school, leave the *Answer/Scoring Sheets* inside the front cover of each booklet. After marking, place all used *Answer/Scoring Sheets* in numerical order followed by any unused forms. Place the forms in the labelled envelope. Do not seal the envelope. If marking is conducted in a central location, place all used *Answer/Scoring Sheets* in numerical order followed by any unused forms. Place the forms in the labelled envelope. Do not seal the envelope.
		9. Complete the *Supervising Teacher Report*. Note any unusual circumstances on this report.
▨		10. Record and shade in the appropriate Reason Code on the pre-printed *Demographic Data Form* for all students who were absent for all sessions (see Appendix 3, page 23).
		11. Record and shade in the appropriate Drop-in Code on the generic *Demographic Data Form* for those students who were not included at the time of registration but were present to write the test (see Appendix 4, page 24).
		12. Ensure that the number of check marks in the "Booklets Submitted to LMC for Marking" column on the *Attendance Forms* matches your count of the booklets and *Answer/Scoring Sheets* for submission.
▨		13. Complete and check the *Student Registration Update Form*. Use the reason codes (Appendix 6, page 26) provided.
		14. Make two copies of the *Attendance Forms* and *Supervising Teacher Report*. One copy must be retained by the school and one forwarded to the local marking site, if a centralized marking model is used.
▨		15. Collect the *Principal Feedback Form*.
		16. Complete the *Supervising Teacher Feedback Form*.

NEW!

Note: Shaded areas indicate the step is not applicable.

Session 1	Session 2	
☐	☐	17. Return all test booklets and other test-related materials to the secure area in the school until commencement of the next session, marking or until materials are to be forwarded to the local marking site.
▨	☐	18. Send materials according to the instructions on the following pages.

Points to Remember

- Remain in the classroom throughout the entire test session and engage in work solely related to the duties of supervising the test.
- A replacement supervisor must be available to assist you.
- Store all documents not in use in a secure area in the school.
- Ensure that once a booklet number has been assigned to a student, all materials distributed to that student have the same booklet number.
- Students may not have access to their test booklets between sessions.
- Students may bring an 8½ × 11 individually prepared study sheet into the test sessions.
- Students may not review or complete work from the previous session.
- Students may use the Internet to access tools employed in the everyday Applied Mathematics (40S) class.

Submitting materials

Schools may use a variety of marking models for the Senior 4 Applied Mathematics (40S) Standards Test. The directions for returning test materials are specific to the marking model used.

Centralized marking (scored at a central location)

Before marking

It is essential that the following materials are packaged and forwarded **to the local marking site** immediately after completion of the test on January 22, 2004:

- **All used** test booklets;
- **All used** *Answer/Scoring Sheets*;
- **All** *Recording Sheets* (for recording marks for the Inquiry Task);
- Copy of the *Attendance Forms*; and
- Copy of the *Supervising Teacher Report*.

All other documentation should be verified and returned **to the Assessment and Evaluation Branch** by the supervising teacher after completion of the test on January 22, 2004.

- **All original** *Attendance Forms*;
- **All** *Demographic Data Forms* (in envelope provided);
- **All** individually prepared study sheets (in envelope provided);
- *Student Registration Update Form*;
- *Supervising Teacher Report*;
- *Supervising Teacher Feedback Form*;
- *Principal Feedback Form*; and
- All damaged or misprinted booklets.

Schools in the City of Winnipeg return their envelopes to the Assessment and Evaluation Branch by calling Mid-Canada Courier (989-5630) and arranging pick-up between **1:00 p.m. and 4:00 p.m.** on **January 22, 2004**. The person placing the call should quote **account number E901**, provide the school name, address and the name of the contact person. (See section "Shipping materials to the department", page 17).

Schools outside the City of Winnipeg return their envelopes to the Assessment and Evaluation Branch by using the Xpresspost Flexipack envelope provided and taking it to the post office.

After marking

When local marking is done at a central location, the local marking co-ordinator is responsible for sending the materials to the Assessment and Evaluation Branch.

After local marking is completed for both components of the standards test, prepare a package to be received by the Assessment and Evaluation Branch no later than January 30, 2004.

The package must include:

- **All** *Answer/Scoring Sheets* and *Recording Sheets*;
- Test booklets (*Inquiry Task* and *Written Test*) requested by the department for feedback on the marking process;
- *Sample Request List*; and
- *Local Marking Co-ordinator Feedback Form.*

School-based and classroom-based marking (scored by classroom teacher)

When local marking is done at the school or classroom level, the school is responsible for sending the materials to the Assessment and Evaluation Branch.

After local marking is completed for both components of the standards test, prepare a package to be received by the Assessment and Evaluation Branch no later than January 30, 2004.

The package must include:

- **All original** *Attendance Forms*;
- **All** *Demographic Data Forms*;
- *Student Registration Update Form*;
- *Supervising Teacher Report*;
- *Supervising Teacher Feedback Form*;
- *Principal Feedback Form*;
- **All** *Answer/Scoring Sheets* and *Recording Sheets*;
- Test booklets (*Inquiry Task* and *Written Test*) requested by the department for feedback on the marking process;
- *Sample Request List*;
- *Local Marking Co-ordinator Feedback Form*; and
- All damaged or misprinted booklets.

Shipping materials to the department

Jurisdictions within the City of Winnipeg send packages directly to the Assessment and Evaluation Branch via Mid-Canada Courier (989-5630). The person placing the call should quote **account number E901**, give the jurisdiction name, address, and the name of the contact person.

Jurisdictions outside the City of Winnipeg return their package by Xpresspost. It is very important to package all materials in the **Xpresspost Flexipack envelope** provided whenever possible.

After the package is sealed, deliver it to the local post office.

We have provided sufficient materials for the return of **one** envelope/package. If you must send a second envelope/package, photocopy the mailing address label and affix the copy to the second package. Note you must use a photocopy of the mailing address label as it provides Canada Post with billing information. Ask the postal clerk for an additional bar code label to attach to the second envelope/package. Ensure that the school representative retains the bar code number in case tracing the package is required.

Return **all** *Answer/Scoring Sheets* and *Recording Sheets*. We remind you that payments will be made according to the number of completed marking sheets received.

Appendices

Appendix 1: Inquiry Task Session Rules

Senior 4 Applied Mathematics (40S) Standards Test

The supervising teacher is expected to read these rules aloud to students at the beginning of the Inquiry Task session of the Senior 4 Applied Mathematics (40S) Standards Test:

- Check the title of your test booklet carefully.
- Write your test booklet number in the upper right-hand corner on your study sheet.
- During this test session, do not proceed until instructed to do so.
- If you receive a damaged or misprinted booklet, raise your hand and I will give you a new one.
- You are expected to remain in the test room until **one hour** of test time has elapsed. (You may leave before that time in exceptional circumstances such as illness, when accompanied by a supervisor.)
- At the beginning of the session you should only have the *Inquiry Task* booklet, a *Demographic Data Form*, an HB pencil, an eraser, a ruler, a protractor, your graphing calculator or computer, and your individually prepared 8½ × 11 study sheet. If you need extra paper to show your work, please raise your hand and I will bring it to you. No other materials are permitted. Do not exchange test materials.
- If you choose to print your answers from the computer, ensure your booklet ID number appears on each page. Remain seated and I will distribute the printouts to you.
- You will not give assistance to, nor receive assistance from another student. If you require something during the test, raise your hand and I will come to you.
- During the test I can help you with the directions, but I will not be able to help you with the test questions.
- Do **not** identify yourself, your school, teacher or town in your test booklet.
- When I ask you to stop writing, put your pencil down immediately.
- You may not discard any materials. The test booklet must remain intact unless otherwise instructed. Any extra paper used must be stapled into the test booklet on the appropriate page. You may **not** leave the room with any materials pertaining to the test.

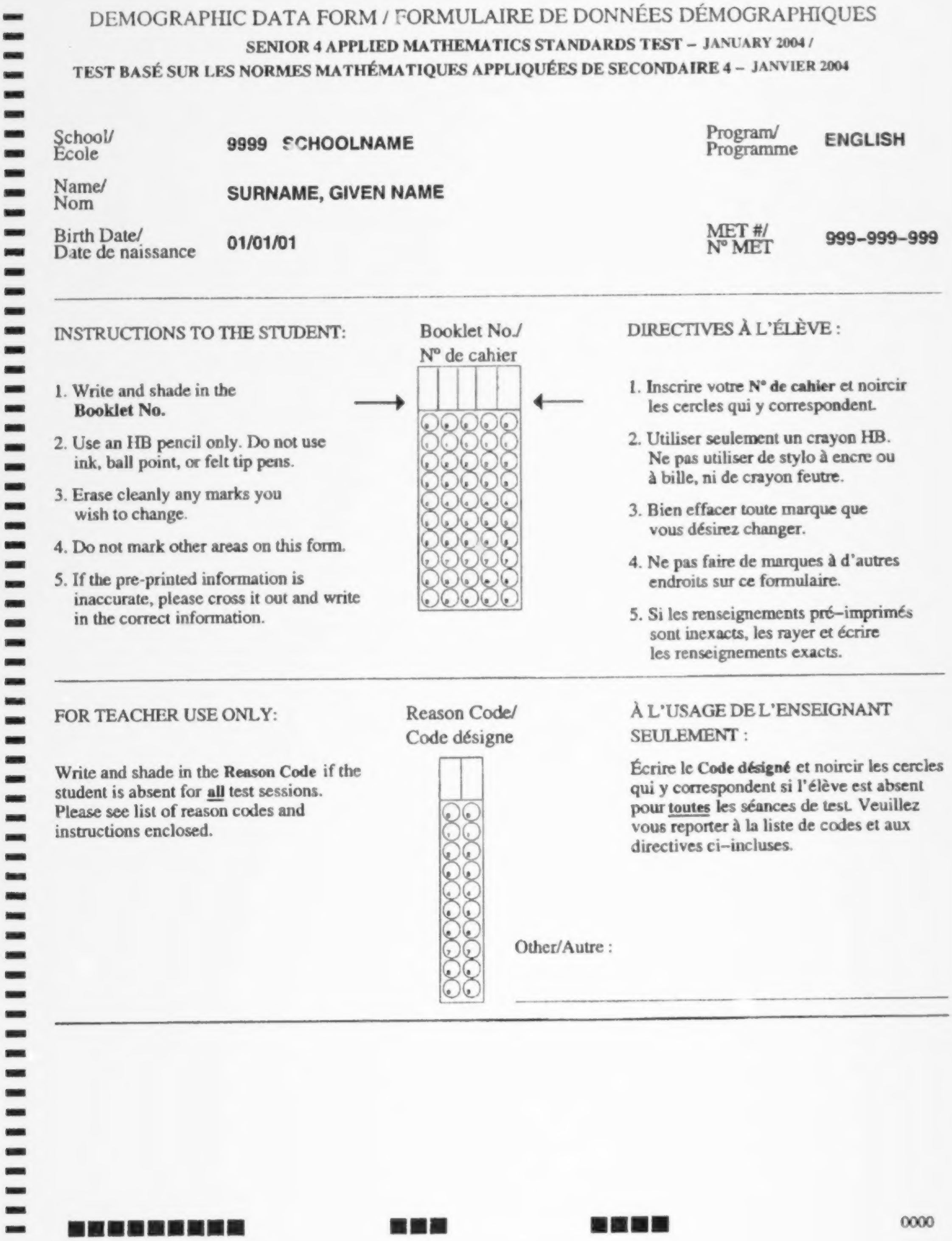
Appendix 2: Written Test Session Rules

Senior 4 Applied Mathematics (40S) Standards Test

The supervising teacher is expected to read these rules aloud to students at the beginning of the Written Test session of the Senior 4 Applied Mathematics (40S) Standards Test:

- Check the title of your test booklet carefully.
- Verify that the booklet number in the upper right-hand corner on your study sheet matches the test booklet number.
- During this test session, do not proceed until instructed to do so.
- If you receive a damaged or misprinted booklet, raise your hand and I will give you a new one.
- You are expected to remain in the test room until **one hour** of test time has elapsed. (You may leave before that time in exceptional circumstances such as illness, when accompanied by a supervisor.)
- At the beginning of the session you should only have the *Written Test* booklet, an *Answer/Scoring Sheet*, an HB pencil, an eraser, a ruler, a protractor, your graphing calculator or computer, and your individually prepared 8½ × 11 study sheet. If you need extra paper to show your work, please raise your hand and I will bring it to you. No other materials are permitted. Do not exchange test materials.
- If you choose to print your answers from the computer, ensure your booklet ID number appears on each page. Remain seated and I will distribute the printouts to you.
- You will not give assistance to, nor receive assistance from another student. If you require something during the test, raise your hand and I will come to you.
- During the test I can help you with the directions, but I will not be able to help you with the test questions.
- Do **not** identify yourself, your school, teacher or town in your test booklet.
- When I ask you to stop writing, put your pencil down immediately.
- You may not discard any materials. The test booklet must remain intact unless otherwise instructed. Any extra paper used must be stapled into the test booklet on the appropriate page. You may **not** leave the room with any materials pertaining to the test.

Appendix 3: Sample Pre-printed Demographic Data Form



DEMOGRAPHIC DATA FORM / FORMULAIRE DE DONNÉES DÉMOGRAPHIQUES

SENIOR 4 APPLIED MATHEMATICS STANDARDS TEST – JANUARY 2004 /

TEST BASÉ SUR LES NORMES MATHÉMATIQUES APPLIQUÉES DE SECONDAIRE 4 – JANVIER 2004

School/ École	**9999 SCHOOLNAME**	Program/ Programme	**ENGLISH**
Name/ Nom	**SURNAME, GIVEN NAME**		
Birth Date/ Date de naissance	**01/01/01**	MET #/ N° MET	**999-999-999**

INSTRUCTIONS TO THE STUDENT:

1. Write and shade in the **Booklet No.**
2. Use an HB pencil only. Do not use ink, ball point, or felt tip pens.
3. Erase cleanly any marks you wish to change.
4. Do not mark other areas on this form.
5. If the pre-printed information is inaccurate, please cross it out and write in the correct information.

Booklet No./
N° de cahier

DIRECTIVES À L'ÉLÈVE :

1. Inscrire votre **N° de cahier** et noircir les cercles qui y correspondent.
2. Utiliser seulement un crayon HB. Ne pas utiliser de stylo à encre ou à bille, ni de crayon feutre.
3. Bien effacer toute marque que vous désirez changer.
4. Ne pas faire de marques à d'autres endroits sur ce formulaire.
5. Si les renseignements pré-imprimés sont inexacts, les rayer et écrire les renseignements exacts.

FOR TEACHER USE ONLY:

Write and shade in the **Reason Code** if the student is absent for all test sessions. Please see list of reason codes and instructions enclosed.

Reason Code/
Code désigne

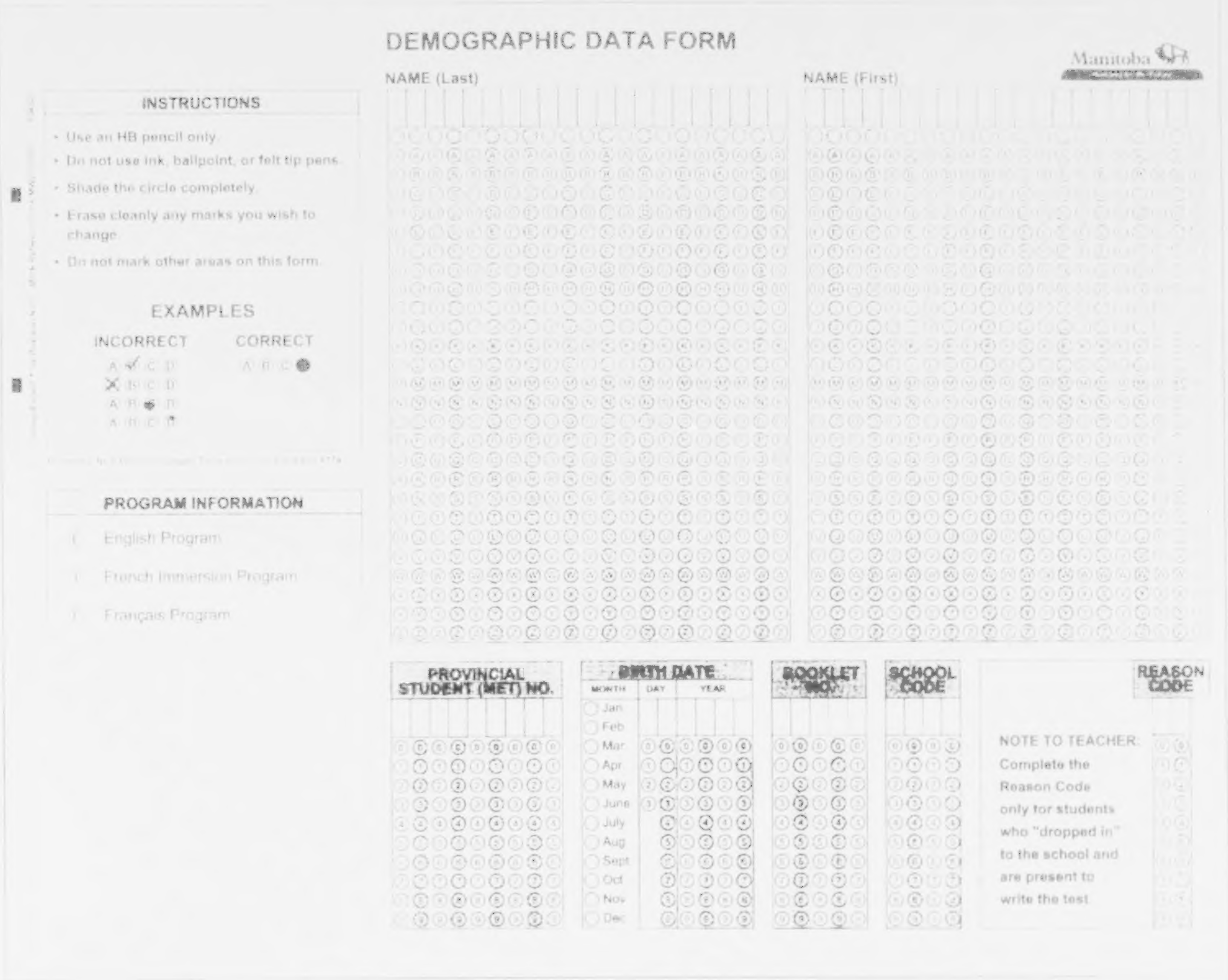
À L'USAGE DE L'ENSEIGNANT SEULEMENT :

Écrire le **Code désigné** et noircir les cercles qui y correspondent si l'élève est absent pour toutes les séances de test. Veuillez vous reporter à la liste de codes et aux directives ci-incluses.

Other/Autre : ______________________________

0000

Appendix 4: Sample Generic Demographic Data Form



DEMOGRAPHIC DATA FORM

Manitoba

NAME (Last)

NAME (First)

INSTRUCTIONS

- Use an HB pencil only.
- Do not use ink, ballpoint, or felt tip pens.
- Shade the circle completely.
- Erase cleanly any marks you wish to change.
- Do not mark other areas on this form.

EXAMPLES

INCORRECT

CORRECT

PROGRAM INFORMATION

○ English Program

○ French Immersion Program

○ Français Program

PROVINCIAL STUDENT (MET) NO.

BIRTH DATE

MONTH DAY YEAR

○ Jan
○ Feb
○ Mar
○ Apr
○ May
○ June
○ July
○ Aug
○ Sept
○ Oct
○ Nov
○ Dec

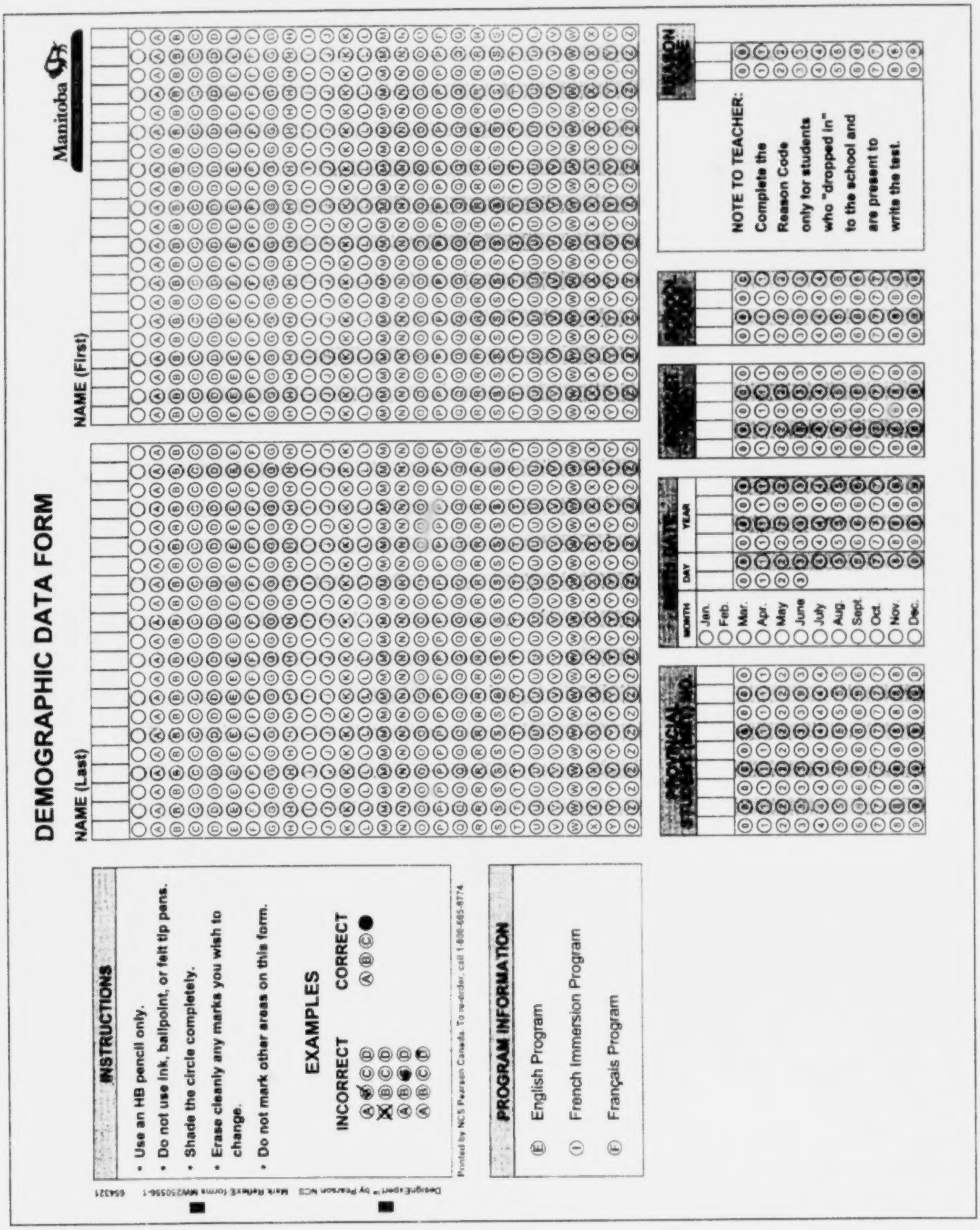
BOOKLET NO.

SCHOOL CODE

REASON CODE

NOTE TO TEACHER:
Complete the Reason Code only for students who "dropped in" to the school and are present to write the test

Appendix 4: Sample Generic Demographic Data Form



Manitoba

DEMOGRAPHIC DATA FORM

NAME (Last)

NAME (First)

INSTRUCTIONS

- Use an HB pencil only.
- Do not use ink, ballpoint, or felt tip pens.
- Shade the circle completely.
- Erase cleanly any marks you wish to change.
- Do not mark other areas on this form.

EXAMPLES

INCORRECT

CORRECT

Printed by NCS Pearson Canada. To re-order, call 1-800-665-9774.

PROGRAM INFORMATION

Ⓔ English Program

Ⓘ French Immersion Program

Ⓕ Français Program

PROVINCIAL STUDENT [illegible] NO.

[illegible] DATE

MONTH DAY YEAR

○ Jan.
○ Feb.
○ Mar.
○ Apr.
○ May
○ June
○ July
○ Aug.
○ Sept.
○ Oct.
○ Nov.
○ Dec.

REASON CODE

NOTE TO TEACHER: Complete the Reason Code only for students who "dropped in" to the school and are present to write the test.

DesignExpert™ by Pearson NCS Mark Reflex® forms MW250556-1 054321

Appendix 5: Sample Attendance Form

School Number: 9999
Somewhere School
Somewhere Address
Somewhere MB R0R 0R0

Page _____ of _____

ATTENDANCE FORM—JANUARY 2004

SENIOR 4 APPLIED MATHEMATICS (40S) STANDARDS TEST

		Student Attendance During Test Sessions		Inquiry Task Booklets Submitted to LMC* for Marking (*check* ✓)	Written Test Booklets Submitted to LMC* for Marking (*check* ✓)
Booklet Number	**Student Name** (*please print*)	**Inquiry Task**	**Written Test**		
10001	Sandra Wong	✓	✓	✓	✓
10002	Kevin Melnychuk	✓	A	✓	
10003	DAMAGED				
10004	Dallas Severn (also 10008)	✓	✓	✓	✓
10005	Manuel Sousa	✓	✓	✓	✓
10006	Robert Smith	A	A		
10007	Julie Curtis	A	✓		✓
10008	Used with 10005 (damaged)				
10009	UNUSED				
10010	UNUSED				

Note: Record a "✓" for Present. An "A" indicates a student is Absent.

Mr. Jim Mederski

Supervising Teacher's Name (*please print*)

Please retain a copy of this form for your records. You will need a copy of this form to link your locally marked test with a student's name.

***Local marking co-ordinator**

Appendix 6: List of Reason Codes to Record Changes in Standards Test Student Registration Numbers

(Please use these codes to complete the *Student Registration Update Form* and the *Demographic Data Form* before returning them to the Assessment and Evaluation Branch in January 2004.)

ABSENT	
01	arrived too late to write the test
02	did not write due to weather
03	family/personal reasons
04	medical/illness/accident
05	out-of-town activity (athletic/academic)
06	religious objections
07	student refused to write
08	unexcused
09	working
19	other (please specify)

WITHDRAWN	
22	dropped course
23	incarcerated/court
24	medical/illness/accident
25	family/personal reasons
26	poor attendance/progress
27	quit school
29	other (please specify)

INCOMPLETE	
40	continuing course/program next semester
41	no work completed
49	other (please specify)

ERRORS IN REGISTRATION	
20	changed program
21	deceased
50	already has credit
51	auditing the course
52	exchange student
53	registered twice
54	quarter system projected registration
55	registered in wrong grade
59	other (please specify)

EXEMPTIONS	
60	emotional/psychological condition or circumstances
61	"M" credit designation
62	"E" credit designation
63	"phase d'accueil—bloc intensif" designation
69	other (please specify)

DROP INS	
70	forgotten on original test registration
71	late registration to course
72	transferred in from another school/province/country
73	rewrite (not currently enrolled)
79	other (please specify)

MIGRANCY	
90	transferred to another school within the province
91	transferred to another school outside of the province
99	other (please specify)

[illegible]

Senior 4 Applied Mathematics (40S) Standards Test

Written Test

January 2004

Manitoba

Building for the Future

SENIOR 4 APPLIED MATHEMATICS (40S)
STANDARDS TEST

DESCRIPTION

Total Possible Marks: 59 **Time: 2.5 hours**

This test consists of two sections:

	Description	**Suggested Time to Complete**	**Marks**
Section A	10 multiple-choice questions worth 1 mark each	20 minutes	10
Section B	14 constructed-response questions worth between 2 and 6 marks each	130 minutes	49

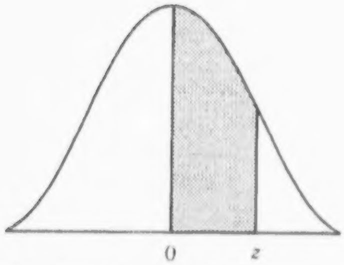
Test Resources and Directions

- Students are provided with the Standard Normal Distribution table and a formula sheet.
- Use of a graphing calculator, computer software or Website is allowed.
- Use of protractor and ruler are allowed.
- Read all instructions on the test carefully.
- In Section A, choose the best response and mark it on the back of the *Demographic Data Form.* Do not fold the *Demographic Data Form* or the test booklet.
- **If you need more space to answer a question, extra pages may be provided by your teacher. Write your booklet ID number and question number on any extra page(s) used and staple it into the booklet where your answer begins. Indicate in the response space of the question that the answer is on a separate sheet.**

Copyright © 2003, the Crown in Right of Manitoba,
as represented by the Minister of Education, Citizenship and Youth.
Manitoba Education, Citizenship and Youth,
Assessment and Evaluation Branch,
Winnipeg, Manitoba R3E 3J5

Permission is hereby given by the copyright owner to reproduce this document on a non-profit basis for educational purposes provided the source is mentioned.

z-Score Chart



Notes:

1. For values of z above 3.09, use 0.4999 for the area.
2. Use these common values that result from interpolation:

z-score	area
1.645	0.4500
2.575	0.4950

The Standard Normal (z) Distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Formula Sheet

Vectors

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\sin x = \frac{\text{o}}{\text{h}} \qquad \cos x = \frac{\text{a}}{\text{h}} \qquad \tan x = \frac{\text{o}}{\text{a}}$$

$$a^2 + b^2 = c^2$$

$$a^2 = b^2 + c^2 - 2bc \cos \text{A}$$

$$b^2 = a^2 + c^2 - 2ac \cos \text{B}$$

$$c^2 = a^2 + b^2 - 2ab \cos \text{C}$$

Personal Finance

$$I = PRT$$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = P(1+i)^n$$

$$\text{mill rate} = \frac{\text{total taxes to be raised}}{\text{total assessed value}} \times 1000$$

Probability

$$\text{P}(\text{A}^{\prime}) = 1 - \text{P}(\text{A})$$

$$\text{P(success)} = \frac{\text{number of successes}}{\text{number of outcomes}}$$

$$\text{P(A or B)} = \text{P(A)} + \text{P(B)} - \text{P(A and B)}$$

$$\text{P(A and B)} = \text{P(A)} \times \text{P(B)}$$

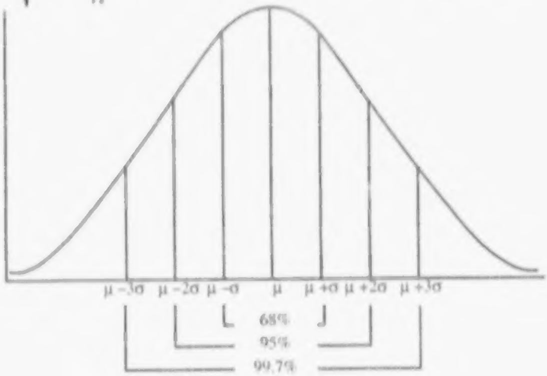
$${}_n\text{P}_r = \frac{n!}{(n-r)!}$$

$${}_n\text{C}_r = \frac{n!}{r!(n-r)!}$$

Variability and Statistics

$$z = \frac{x - \bar{x}}{\sigma} \qquad \bar{x} = \frac{\sum x}{n} \text{ or } \bar{x} = np$$

$$\sigma = \sqrt{\frac{\sum (x-\mu)^2}{n}} \qquad \sigma = \sqrt{npq} \qquad \mu = np$$



Design and Measurement

Rectangle: Area = $\ell \times w$

Circle: Area = πr^2 Circumference = $2\pi r$

Triangle: Area = $\frac{bh}{2}$

or $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$

Trapezoid: Area = $\left(\frac{b_1 + b_2}{2}\right)h$

Prism: Surface area = $Ph + 2B$

Volume = $B \times h$

Pyramid: Volume = $\frac{B \times h}{3}$

Sphere: Volume = $\frac{4}{3}\pi r^3$ Surface area = $4\pi r^2$

Cylinder: Volume = $\pi r^2 h$ Surface area = $2\pi rh + 2\pi r^2$

Periodic Functions

$$\text{Period} = \frac{2\pi}{\text{Frequency}} \text{ or } \frac{2\pi}{b}$$

$$y = a\sin(bx + c) + d$$

$$y = a\cos(bx + c) + d$$

SECTION A: MULTIPLE-CHOICE

Value: 10 marks **Suggested Time: 20 minutes**

1. If $A = \begin{bmatrix} 2 & 5 \\ 3 & 1 \end{bmatrix}$, then $A^2 =$

A) $\begin{bmatrix} 4 & 10 \\ 6 & 2 \end{bmatrix}$

B) $\begin{bmatrix} 4 & 25 \\ 9 & 1 \end{bmatrix}$

C) $\begin{bmatrix} 4 & 7 \\ 5 & 3 \end{bmatrix}$

D) $\begin{bmatrix} 19 & 15 \\ 9 & 16 \end{bmatrix}$

2. Jim travels 30 km north and 40 km west at a constant speed of 20 km/hr.

How long will it take him to return directly to his starting point?

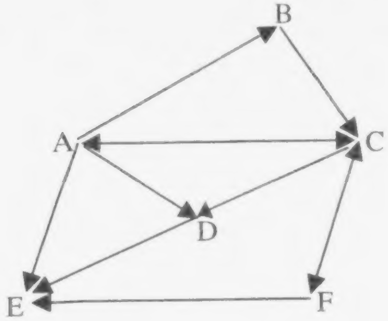
A) ½ hour

B) 2 hours

C) 2 ½ hours

D) 3 ½ hours

3. Which statement is true for the diagram below?



A) $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{CA}$

B) $\overrightarrow{CD} + \overrightarrow{CA} = \overrightarrow{AD}$

C) $\overrightarrow{AC} + \overrightarrow{CE} = \overrightarrow{FC} + \overrightarrow{CE}$

D) $\overrightarrow{CA} + \overrightarrow{AE} = \overrightarrow{CF} + \overrightarrow{FE}$

4. A lake contains bass, pickerel, trout and pike. Each type of fish comes in four size categories, small, medium, large and extra large. There is an equal probability of catching each type or size of fish.

What is the probability of catching a trout **OR** an extra large fish?

A) 1/16

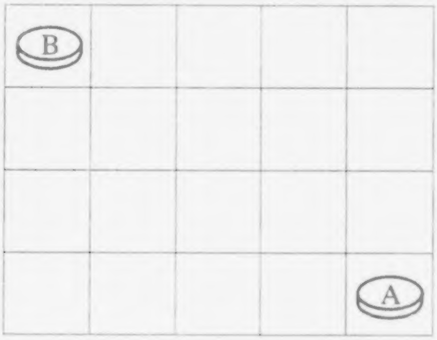
B) 7/16

C) 1/2

D) 9/16

5. A game piece is to be moved from square A to square B on the board below by moving **within** the squares to the left or upward only.

How many different pathways are possible?



A) 12

B) 20

C) 35

D) 126

6. Boxes of chocolate candies have been found to contain on average 43.6 candies, with a standard deviation of 2.2.

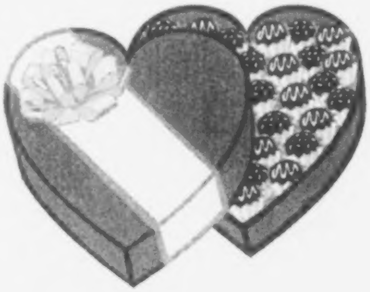
If the distribution is normal, how many standard deviations from the mean is a box with 48 candies?

A) 1.0

B) 2.0

C) 2.2

D) 4.4



7. Andrea wrote a statistics test where the marks were normally distributed with a mean of 67 and a standard deviation of 4.3.

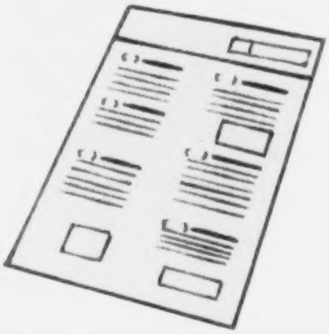
Calculate her z-score if her mark on the test was 77.

A) –2.33

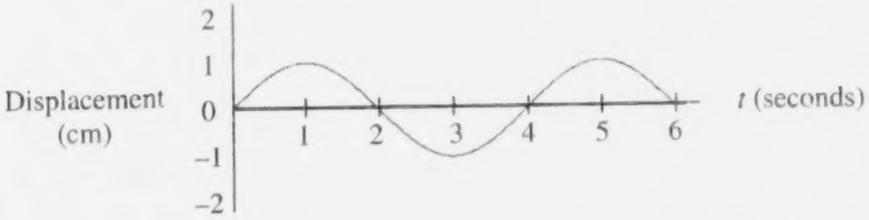
B) 2.33

C) 5.7

D) 10.0



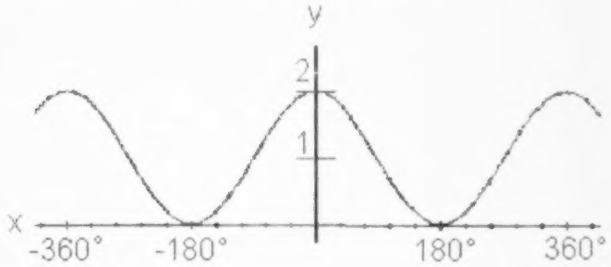
8. A periodic function is illustrated below:



Determine the correct values for the amplitude, period and minimum value.

	Amplitude (cm)	Period (s)	Minimum (cm)
A)	1	2	–1
B)	2	2	0
C)	2	4	0
D)	1	4	–1

9. Over the interval $-360° \le x \le 360°$ the function best represented by the graph is:



A) $y = \sin(x + 90°) + 1$

B) $y = \sin(x + 90°)$

C) $y = \sin(x) + 1$

D) $y = \sin(x - 90°)$

10. The first 3 generations of a fractal pattern are shown. For each new generation, a new triangle is inscribed inside **each** triangle, with vertices at midpoints of the original sides.

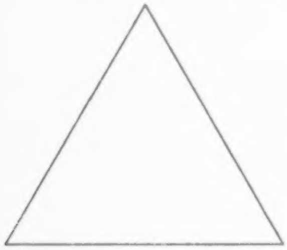
Determine the total number of new **identical** triangles that would exist in Generation 6.

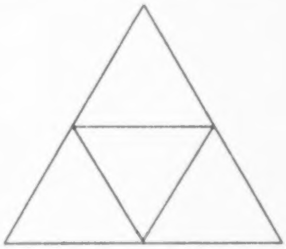
A) 256

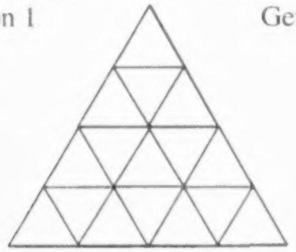
B) 512

C) 1024

D) 4096


Generation 1


Generation 2


Generation 3

BLANK PAGE

SECTION B: CONSTRUCTED-RESPONSE

(Value: 49 marks) **(Suggested Time: 130 minutes)**

DIRECTIONS

- There are 14 constructed-response questions in this section of the test. Each question is worth between 2 and 6 marks.
- Provide **complete answers** in the spaces provided in the test booklet. You may print out sketches from the computer or your calculator where applicable. Make sure these printouts contain your booklet ID number. Remain seated and your teacher will distribute these printouts to you. Staple the printouts in the booklet where the question begins. Indicate in the response space of the question that the answer is on a printed sheet.
- Provide clear explanations or justifications where applicable. This could be done through labelled diagrams, in words, by showing mathematical operations to verify your answer, or by referencing a software or a calculator program.
  - If you reference a calculator program indicate your input values.
  - If you reference a spreadsheet, print a copy of the formulas and a copy of the answers.
  - If you reference a Web site, indicate your input values and print or copy the screen showing answers.
- Let the mark values for each question guide your time and the amount of detail you use in your answer. Mark values for subsections of a question are indicated in parentheses.
- Round your final answers to the nearest two decimal places.
- Unless otherwise specified, it is not necessary to draw sketches to scale. If you draw a scale diagram, make sure you indicate your scale.
- An answer without any work shown will be considered incomplete.
- Always state your assumptions.

BLANK PAGE

DO NOT USE

101

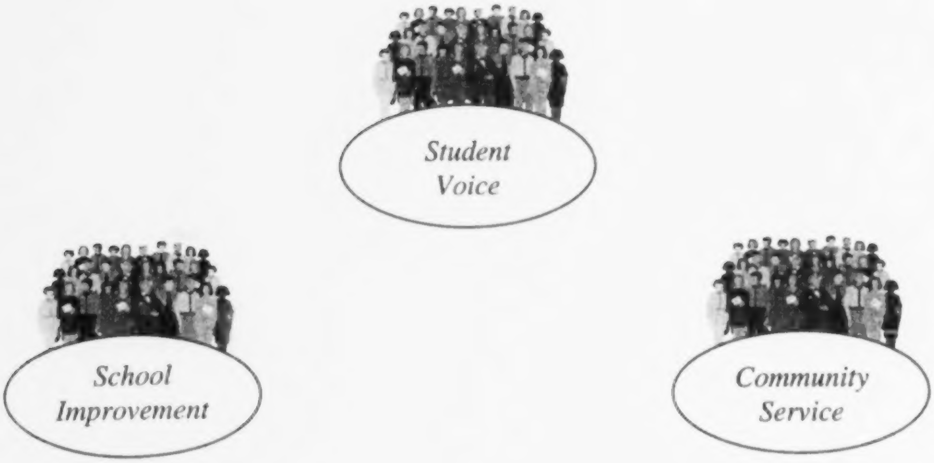
11. At Plains High School, students are asked to join one school committee. Their choices include: *School Improvement*, *Student Voice* and *Community Service*. Students are allowed to change committees at the end of each school year. Below are the switching behaviours of the students.

Total: 6 marks

- *School Improvement* loses 4% of it's members to *Community Service* and 7% to *Student Voice*.
- 5% of the *Student Voice* committee members join the *School Improvement* committee the next year and 4% become members of *Community Service*.
- 2% leave *Community Service* to become *School Improvement* members and 6% leave to join *Student Voice*.

a) Draw a transition diagram that illustrates this switching behaviour.

(1 mark)



DO NOT USE

b) Complete a transition matrix.

(2 marks)

$$\begin{array}{c|ccc|} & SI & SV & CS \\ \hline SI & & & \\ SV & & & \\ CS & & & \\ \hline \end{array}$$

c) Last year's committee membership is shown in the matrix below:

(1 mark)

$$\begin{array}{ccc} SI & SV & CS \\ \left[62\right. & 42 & \left.51\right] \end{array}$$

Using matrix operations, state the current membership of each committee.

d) Every year the *School Improvement* committee has a Spirit Week which requires the help of 55 committee members. Use matrices to determine the future of this committee and of Spirit Week. Support your answer.

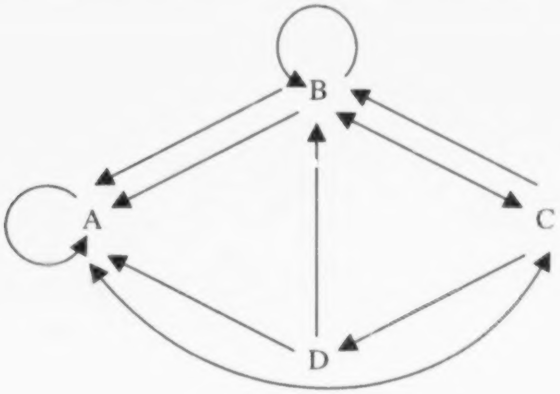
(2 marks)

DO NOT USE

102

12. The diagram below shows a set of pathways that connects 4 communication devices. The arrows indicate the direction in which communication can take place.

Total: 3 marks



a) Create a matrix to describe the communication pathways.

(1 mark)

$$\begin{array}{cc} & \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{array}{c} A \\ B \\ C \\ D \end{array} & \left[\begin{array}{cccc} \quad & \quad & \quad & \quad \\ & & & \\ & & & \\ & & & \end{array} \right] \end{array}$$

b) Determine the matrix that represents the number of ways communication can occur from one communication device to another using **exactly** one relay.

(1 mark)

c) Show the matrix operations that you would perform to find the number of ways communication can occur from one device to another using **at most** two relays.

(1 mark)

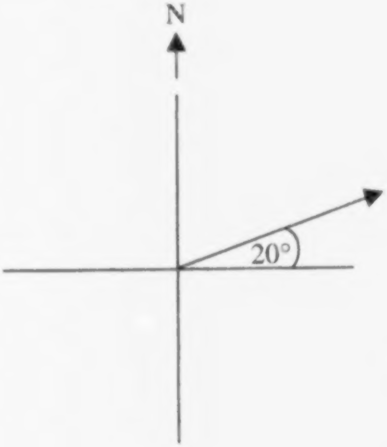
DO NOT USE

13. The vector diagram below provides information about a wind. Use this information to determine the magnitude and the direction of the wind.

Total: 2 marks

103

1 cm = 10 km/hr



14. After her parachute opens, a skydiver falls toward the earth at an average rate of 4.7 m/sec. During her jump a wind pushes her at a horizontal rate of 1.1 m/sec.

Total: 2 marks

104

What is the skydiver's resultant direction? Indicate how you arrived at your answer.

15. An oil tanker has become stranded off the coast of Canada. Two tugboats have been sent to pull the ship to shore. One tugboat will pull with a force of 53 000 N at a bearing of 65°, while the other will pull with a force of 59 000 N at a bearing of 120°.

Total: 4 marks

DO NOT USE

105

a) Provide a complete, labelled vector diagram to illustrate this situation.

(2 marks)

b) A force of 95 000 N is required to move the oil tanker. Determine the direction the tanker would move, and determine whether these two tugboats are able to pull the tanker to shore. Justify your answer.

(2 marks)

16. From a class of 30 students, 5 will be selected to attend a student conference.

DO NOT USE

106

Total: 2 marks

(1 mark) a) How many different groups of five can be picked?

(1 mark) b) After 5 students are selected, each is assigned a different responsibility. In how many ways can the responsibilities be assigned to these 5 students?

DO NOT USE

17. Bill wishes to purchase a new truck. He must make the following choices:

Total: 3 marks

- **colour**: red, green, blue or white
- **CD player**: yes or no
- **transmission**: standard or automatic

107

Assume there is an equal probability for each choice.

a) What is the probability that he will choose a truck that has standard transmission and is red?

(1 mark)

b) What is the probability that he will choose a truck that has an automatic transmission and a CD player, and is either green or white?

(1 mark)

c) What is the probability that a truck has a CD player or automatic transmission?

(1 mark)

DO NO
USE

18. Eight percent of students attending a Hallowe'en dance are former students, while the others are currently enrolled. Thirty-two percent of those attending wear costumes.

Total:
3 marks

(2 marks) a) Create a sample space to determine the probability that a randomly selected student is a former student not in costume.

108

(1 mark) b) If 200 people attend the dance, how many former students are not in costume?

DO NOT USE

19. Based on past surveys, an average of 445 out of 500 hockey players like their coaches, with a standard deviation of 7.

109

Total: 3 marks

a) Calculate a 95% confidence interval for the percent of hockey players who like their coaches. Support your answer.

(2 marks)

b) Explain the meaning of the confidence interval in relation to hockey coaches.

(1 mark)

DO NO
USE

110

20. A local modelling agency hires males who are 168 – 195 cm in height, and females who are 158 – 186 cm in height. The heights of males and females in this area are normally distributed with a mean and standard deviation as follows:

Total:
6 marks

	$\overline{x}$	σ
Males	176 cm	7
Females	163 cm	8

a) Calculate the percentage of males who would not qualify for employment with this agency because they are too tall. Support your answer.

(2 marks)

b) The agency claims that both males and females have an equal chance of being hired. Use statistics to prove or disprove their claim. Support your answer.

(2 marks)

c) The agency wishes to change its criteria so that the tallest 84% of women qualify for employment. What is the new minimum height requirement for women? Support your answer.

(2 marks)

DO NOT USE

111

21. Two business partners, Mr. Smith and Mr. Jones, have consulted biorhythm graphs to determine the ideal and most appropriate time to conduct the grand opening of their new store. Their personalized biorhythm graphs show how their energy levels fluctuate during the day and correspond to the equations below:

Total: 4 marks

Mr. Smith: $E = 1.3\sin(1.3t) + 0.5$
Mr. Jones: $E = 1.3\sin(1.87t) + 0.5$

Time in hours is measured on the horizontal axis, and energy level is measured on the vertical axis.

a) If $t = 0$ at midnight, at what time of day should they hold their grand opening? Use their biorhythm graphs to explain why.

(2 marks)

b) Identify the period of the equation of Mr. Jones's biorhythm. Explain what this period means by comparing it with Mr. Smith's biorhythm.

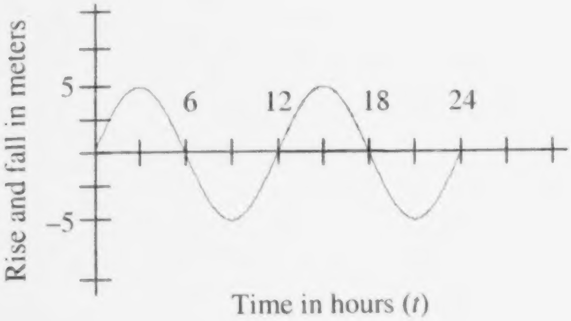
(2 marks)

DO NO
USE

112

22. The ocean tides rise and fall periodically as shown in the graph below.

Total:
3 marks



a) Determine the equation of the graph.

(2 marks)

b) To the nearest tenth of an hour, after how many hours does the tide first reach 4 metres?

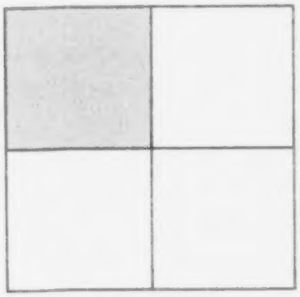
(1 mark)

DO NOT USE

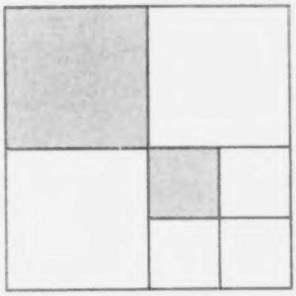
113

23. Two generations of a fractal pattern are shown in the diagram below.

Total:
4 marks



Generation 1



Generation 2

a) Write instructions for creating the next generation of the fractal.

(2 marks)

b) If the side length of the original shaded square is 4 cm, what would the **sum** of **all** shaded areas be in generation 4? Show all work.

(2 marks)

DO NOT USE

24. You would like to sell your car by advertising in a local newspaper. The advertisement costs \$32.00 for the first day. If your car does not sell the first day, the newspaper applies a daily 5% discount, and a daily \$3.00 reduction in the cost of the advertisement. The reductions apply on the second day and continue until your car is sold or until the cost of the advertisement is \$0.

Total: 4 marks

114

a) Determine the cost of the advertisement on day 5, if the car does not sell. Show your work and state your assumptions.

(2 marks)

b) Which day does the price of the advertisement become \$0?

(1 mark)

c) Assuming that the car does not sell for several weeks, what is the maximum total amount you would pay for advertising in this newspaper?

(1 mark)

END OF TEST

Senior 4 Applied Mathematics (40S) Standards Test

Inquiry Task

January 2004

Manitoba
Building for the Future

Copyright © 2003, the Crown in Right of Manitoba,
as represented by the Minister of Education, Citizenship and Youth.
Manitoba Education, Citizenship and Youth,
Assessment and Evaluation Branch,
Winnipeg, Manitoba R3E 3J5

Permission is hereby given by the copyright owner to reproduce this document on a non-profit basis for educational purposes provided the source is mentioned.

Formula Sheet

Vectors

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\sin x = \frac{\text{o}}{\text{h}} \qquad \cos x = \frac{\text{a}}{\text{h}} \qquad \tan x = \frac{\text{o}}{\text{a}}$$

$$a^2 + b^2 = c^2$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

Personal Finance

$$I = PRT$$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = P(1+i)^n$$

$$\text{mill rate} = \frac{\text{total taxes to be raised}}{\text{total assessed value}} \times 1000$$

Probability

$$P(A^{|}) = 1 - P(A)$$

$$P(\text{success}) = \frac{\text{number of successes}}{\text{number of outcomes}}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A) \times P(B)$$

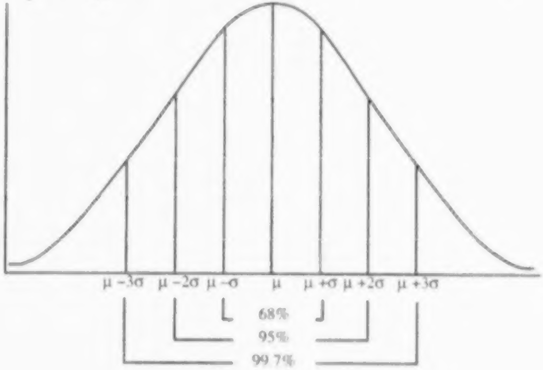
$$_nP_r = \frac{n!}{(n-r)!}$$

$$_nC_r = \frac{n!}{r!(n-r)!}$$

Variability and Statistics

$$z = \frac{x - \bar{x}}{\sigma} \qquad \bar{x} = \frac{\sum x}{n} \text{ or } \bar{x} = np$$

$$\sigma = \sqrt{\frac{\sum (x-\mu)^2}{n}} \qquad \sigma = \sqrt{npq} \qquad \mu = np$$



Design and Measurement

Rectangle: Area = $\ell \times w$

Circle: Area = πr^2 Circumference = $2\pi r$

Triangle: Area = $\frac{bh}{2}$

or $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$

Trapezoid: Area = $\left(\frac{b_1 + b_2}{2}\right)h$

Prism: Surface area = $Ph + 2B$

Volume = $B \times h$

Pyramid: Volume = $\frac{B \times h}{3}$

Sphere: Volume = $\frac{4}{3}\pi r^3$ Surface area = $4\pi r^2$

Cylinder: Volume = $\pi r^2 h$ Surface area = $2\pi rh + 2\pi r^2$

Periodic Functions

$$\text{Period} = \frac{2\pi}{\text{Frequency}} \text{ or } \frac{2\pi}{b}$$

$$y = a\sin(bx+c) + d$$

$$y = a\cos(bx+c) + d$$

BLANK PAGE

SENIOR 4 APPLIED MATHEMATICS (40S)
STANDARDS TEST

DESCRIPTION

Total Possible Marks: 21 **Time: 2 hours**

This test consists of two tasks:

	Description	**Suggested Time to Complete**	**Marks**
Task 1	Contains questions on Personal Finance worth 10 marks	60 minutes	10
Task 2	Contains questions on Design and Measurement worth 11 marks	60 minutes	11

Test Resources and Directions

- This test should be written with the assistance of computer software and/or a graphing calculator.
- You are provided with a formula sheet.
- If you use a graphing calculator, make sure you indicate all the values you entered in the space provided in this booklet.
- If you use a spreadsheet, make sure you print two copies of your spreadsheets, one showing the answers and one showing the formulas. Indicate your booklet ID number on each printout. Remain seated and your teacher will distribute these printouts to you.
- If you use a Website, make sure you indicate all the values you entered, and print or copy the screen, showing answers.
- Please staple printed copies of all your work on the page of the question. Indicate your booklet ID number on each page. Indicate in the response space of the question that the answer is on a printed sheet.
- Clearly identify the question number on your answer sheet(s) (e.g., Question 2b).
- Always state your assumptions.

PERSONAL FINANCE

DO NOT USE

115

Total: 10 marks

1. Sally plans to purchase a vehicle for $24 549.90 including PST and GST. Sally has also been given a gift of $3000.00 from her grandparents. She must decide on one of two options for purchasing the vehicle.

(1 mark) **One mark will be awarded for clearly showing your work or strategy and all calculated results.**

Option 1

Sally can pay for the car by taking out a loan for the entire amount at a rate of 8.75% compounded monthly for 5 years. She can invest the $3000.00 for 5 years at 6% compounded semi-annually.

a) What will Sally's monthly loan payment be?

(1 mark)

b) How much will Sally's investment be worth in 5 years?

(1 mark)

DO NOT USE

Option 2

Sally uses her $3000.00 gift as a down payment on her car. She finances the remaining amount with a loan at a rate of 8.75% compounded monthly for 5 years.

c) What will Sally's new monthly loan payment be?

(1 mark)

d) Sally decides to invest the difference between the loan payment of Option 1 and the loan payment of Option 2 for 5 years. She deposits this amount each month into her savings account, which pays 1.5% annual interest compounded monthly. How much will Sally's investment be worth in 5 years?

(2 marks)

e) Provide an analysis to compare the total costs and benefits for each option. State one advantage for choosing each option.

(4 marks)

DO NOT USE

BLANK PAGE

DO NOT USE

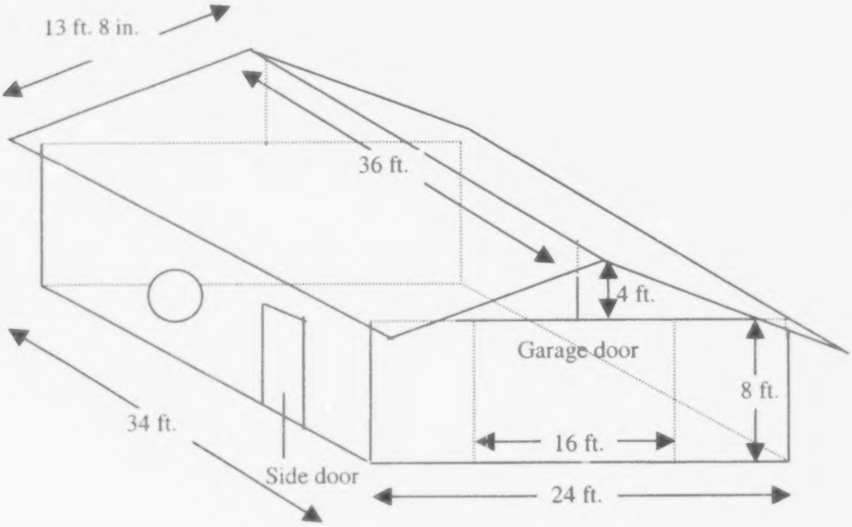
DESIGN AND MEASUREMENT

2. A group of high school students has formed a company called Manitoba Stucco and Roofing. A customer has given them a sketch of a garage and has requested a cost estimate for both stucco and aluminum roofing.

Total: 11 marks

116

- **Clearly organize and show all calculations.**
- **Stucco, aluminum and strapping must be purchased in whole units.**



Stucco
The stucco is to cover **all exterior areas** except for the following:

- roof
- garage door 16 ft. × 8 ft.
- side door 3 ft. × 6 ft. 8 in.
- circular window with a 3 ft. diameter

The cost of applying stucco is \$19.95/yd^2.

DO NOT USE

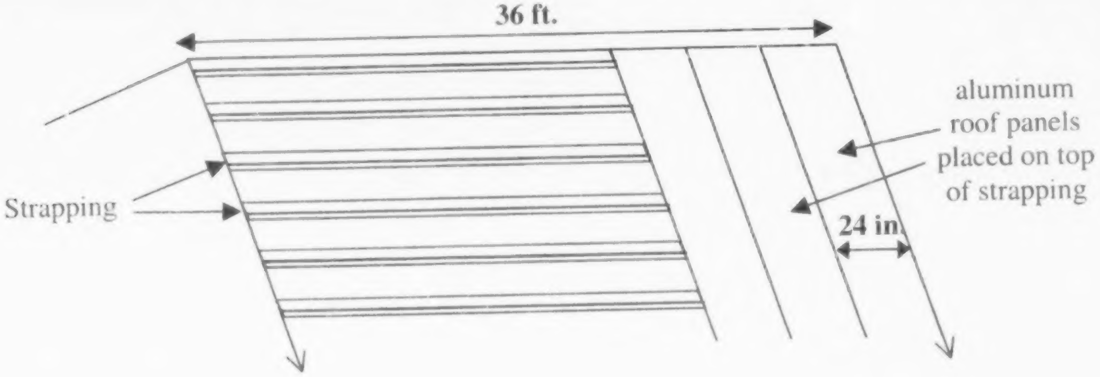
a) Calculate the area to be covered by stucco.
(4 marks)

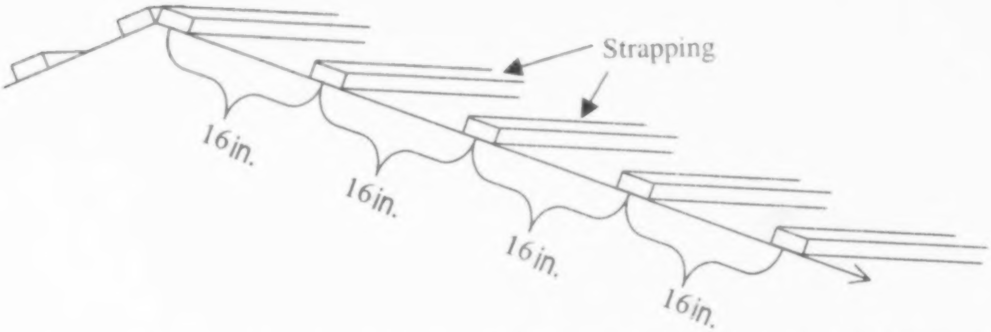
b) Calculate the total cost of applying stucco, including PST and GST.
(2 marks)

DO NO
USE

Roofing

Before a new metal roof can be attached, 1 in. x 4 in. strapping is nailed to the roof, as shown in the diagrams.


36 ft.
aluminum roof panels placed on top of strapping
Strapping
24 in.


Strapping
16 in.
16 in.
16 in.
16 in.

- There are 16 inches from the centre of one piece of strapping to the centre of the next.
- The cost of strapping is \$0.17 per linear foot.
- Aluminum roofing material costs \$13.50 per linear foot, in sheets 24 in. wide.
- Hardware and finishings cost \$100.00, plus taxes.

c) Calculate the total cost of the new roof. State all assumptions.

(5 marks)

END OF TEST

NO MARKS WILL BE AWARDED FOR WORK DONE
ON THIS PAGE

Senior 4 Applied Mathematics (40S) Standards Test

Marking Guide

January 2004

Manitoba
Building for the Future

Senior 4 Applied Mathematics (40S) Standards Test

Marking Guide

January 2004

Manitoba

Building for the Future

Copyright © 2003, the Crown in Right of Manitoba,
as represented by the Minister of Education, Citizenship and Youth.
Manitoba Education, Citizenship and Youth,
Assessment and Evaluation Branch,
Winnipeg, Manitoba R3E 3J5

Permission is hereby given by the copyright owner to reproduce this document on a non-profit basis for educational purposes provided the source is mentioned.

Table of Contents

General Instructions **1**

Answer Key for Multiple-choice items **5**
Marking Keys and Scoring Rubrics for Constructed-response items **7**
Marking Keys and Scoring Rubrics for the Inquiry Task **77**

Appendices **107**
A-*Table of Specific Outcome Match and Item Type* 109
B-*Generating Student Profiles* Sheet 111
C-*Sheets for marking the Inquiry Tasks* 113

General Instructions

Organization of document:

Following the general instructions for marking, the document is divided into three sections:

- Answer key for multiple-choice items
- Marking keys and scoring rubrics for constructed-response items
- Marking keys and scoring rubrics for the Inquiry Task

The first section presents the answers for the multiple-choice items in a table accompanied by the learning outcome(s) associated with each item. In the second section, each test item is presented in bold characters, followed by a series of typical and possible answers. A marking key or scoring rubric details how the marks are to be allocated for each sub-section of the question. Marking keys are used to mark restricted-response items (with or without explanations). Scoring rubrics are to be used for scoring open-response items.

For each question, the item type, the maximum number of marks possible as well as the specific outcomes targeted by the item are identified at the top of the page. Items are presented in the order that they appear on the standards test. Each open-response item as well as each Inquiry Task item is followed by a series of student exemplars. Student exemplars are chosen to exemplify the use of scoring rubrics or marking keys. The mark value allocated and a rationale justifying the mark allocation accompany each student exemplar.

General Marking Instructions

Please make no marks in the test booklets.

Please ensure that:

- each student's final result is recorded, by test booklet number, on the corresponding ***Answer/Scoring Sheet*** (computer scan sheet);
- the totals are written at the bottom;
- the *Answer/Scoring Sheet* is complete and correct;
- a copy has been made for school records; and
- **only a pencil is used to complete the *Answer/Scoring Sheets*, by both students and markers.**

Once marking is completed, please forward the *Answer/Scoring Sheets* to Manitoba Education, Citizenship and Youth (for more information see the *Administration Manual for Supervising Teachers*).

Scoring the Multiple-choice items

Please follow the answer key provided on page 5 of this document.

Types of student errors

As a guiding principle, students should only be penalized once for each error committed in the context of a test item. For example, students may choose an inappropriate but still relevant strategy for an item but carry it through correctly and arrive at an incorrect answer. In such cases, students should be penalized for having selected an inappropriate strategy for the task at hand but should be given credit for having arrived at an answer consistent with their choice of strategy.

Please note that for all questions in the vectors unit, allow a flexibility of ±3 mm and ±3° when marking students' scale diagrams.

Throughout this document, four types of errors have been identified. These are defined briefly below:

Trivial errors:
These are errors for which no marks are to be deducted. In order to be considered trivial, an error must be conceptually unrelated to the learning outcome(s) associated with the item and not lead to a mathematically incorrect answer. Examples include omitting labels, omitting to carry a negative sign in an algebraic task or not rounding final answers.

Technical communication errors:
These are errors of mathematical notation that are conceptually related to the curriculum outcomes. It is important to note, however, that such errors do not prevent students from arriving at a mathematically correct answer.
Examples include:

- incorrect use of brackets on matrices;
- not expressing transition matrices as decimals or percentages;
- missing more than one vector head in a response;
- not stating a scale when using a scale diagram as a strategy; and
- not buying in whole units in the design and measurement unit.

In such cases, students are to be penalized no more than a half mark per question for each type of error, and only when the corresponding criteria are awarded.

Minor errors:
These are errors that are generally not conceptual in nature but will inevitably lead to an incorrect answer. In such cases, students are generally penalized one mark depending on the details provided in the marking key or scoring rubric.

Major errors:
These are errors or omissions that are conceptual in nature and clearly reflect a gap in the student's knowledge of the specific learning outcome(s). These types of errors often limit the number of marks that can be awarded to a student's response.

Scoring the Constructed-response items

The respective marking key or scoring rubric should be used in conjunction with the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (Applied section) when assigning scores to student responses.

Scoring Guidelines—Restricted-response items (with or without explanation)

Each item of this type is designed to elicit a well-defined response according to the associated specific outcome(s) and relevant mathematical processes. Their purpose is to determine whether a student meets the standards for the course (level 2) as they relate to the knowledge and skills associated with the item.

To receive full marks, a student's response must be complete and correct. Partial marks may be awarded for a "relevant strategy" with execution errors. **A relevant strategy is defined as one that is consistent with the specific outcome(s) and mathematical processes associated with the item that, if properly executed, would lead to the correct answer.** Where alternative strategies are possible, the marking key makes mention of them.

It is important to note that some items require some form of explanation or justification from students. Such explanations and justifications can take various forms depending on students' learning styles. Therefore, marking of student responses needs to reflect appropriate flexibility in this regard. Test instructions to students have clearly specified that explanations or justifications can be done through labeled diagrams, in words, by showing mathematical operations for answer verification or by referencing software, a calculator program or a Web site.

Scoring Guidelines—Open-response items

These items are designed to elicit student responses at any of the three levels of achievement defined in the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (Applied section). The rubrics contain the language of the curricular standards in order to facilitate scoring in a manner that is consistent with those standards. The recommended procedure for scoring student responses is as follows:

1. Read the relevant specific outcome(s) in the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (Applied section).
2. Read the possible solution(s) provided in this document.
3. Study the student exemplars provided and the rationales for the assigned scores.

4. Carefully view all of the student's response and decide which of the three levels of achievement ("exceptional understanding", "good understanding" or "limited understanding") best applies. Whether the response clearly fits into one category or straddles two, this process will narrow down the number of possible scores that can be assigned to the response.
5. Compare the features of the student's response with the general performance indicators accompanying the mark values and the specific performance indicators (criteria) contained in the rubric. Note that the specific performance indicators only typify a student's response in a given score category. An exact match is not anticipated.

Assistance

If, during marking, any issue arises that cannot be resolved locally, please call Manitoba Education, Citizenship and Youth at the earliest opportunity to advise and/or seek assistance. If required, we will connect you to an advisor. Also, please be sure to notify us before making any modifications to the answer/marking keys or scoring rubrics.

Contact person: Philippe Le Dorze at 945-0670 (1 800 282-8069, extension 0670)

Answer Key for Multiple-choice items

Question No.	Answer	Outcome
1	D	A1
2	C	B2
3	D	B1
4	B	D4
5	C	D1
6	B	E1
7	B	E2
8	D	G1
9	A	G2
10	C	H2

BLANK PAGE

Marking Keys and Scoring Rubrics for Constructed-response items

Specific Outcomes: A1, A2 **Item Type: Open Response**

Question No. 11 and Answer

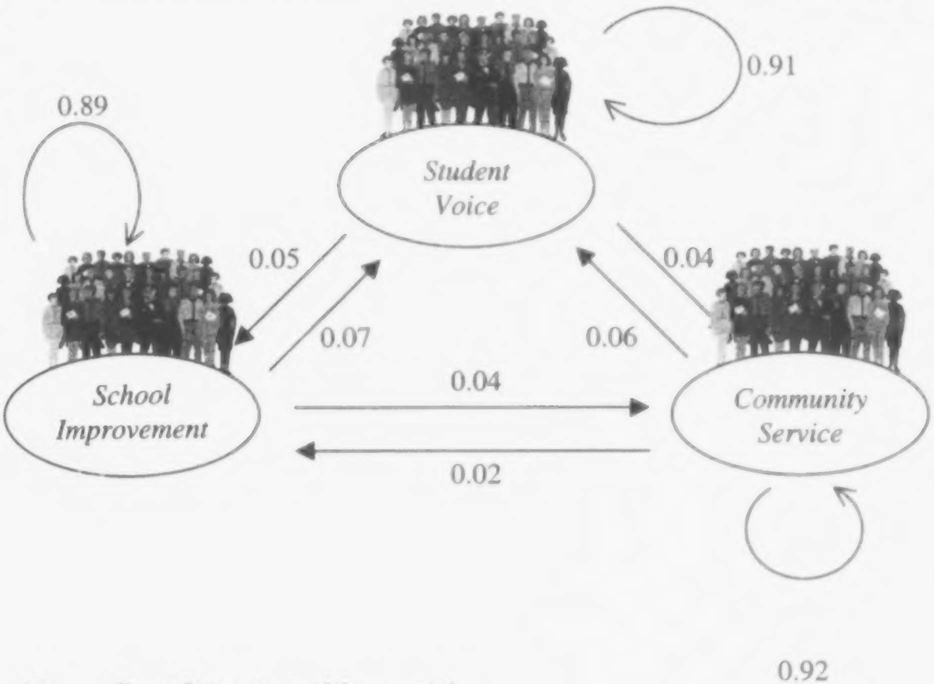
Total:
6 marks

At Plains High School, students are asked to join one school committee. Their choices include: *School Improvement*, *Student Voice* and *Community Service*. Students are allowed to change committees at the end of each school year. Below are the switching behaviours of the students.

- ***School Improvement* loses 4% of it's members to *Community Service* and 7% to *Student Voice*.**
- **5% of the *Student Voice* committee members join the *School Improvement* committee the next year and 4% become members of *Community Service*.**
- **2% leave *Community Service* to become *School Improvement* members and 6% leave to join *Student Voice*.**

a) Draw a transition diagram that illustrates this switching behaviour.

(1 mark)



b) Complete a transition matrix.

(2 marks)

$$T = \begin{array}{c} \\ SI \\ SV \\ CS \end{array} \begin{array}{c} \begin{array}{ccc} SI & SV & CS \end{array} \\ \begin{bmatrix} 0.89 & 0.07 & 0.04 \\ 0.05 & 0.91 & 0.04 \\ 0.02 & 0.06 & 0.92 \end{bmatrix} \end{array}$$

Question No. 11 continued

c) **Last year's committee membership is shown in the matrix below:**

$$\begin{array}{ccc} SI & SV & CS \\ \left[62\right. & 42 & \left.51\right] \end{array}$$

Using matrix operations, state the current membership of each committee.

(1 mark)

Membership = [58.3 45.62 51.08]

d) **Every year the *School Improvement* committee has a Spirit Week which requires the help of 55 committee members. Use matrices to determine the future of this committee and of Spirit Week. Support your answer.**

(2 marks)

this year = [58.3 45.62 51.08]

or round for people (accept both)

next year = [55.19 48.66 57.15]

following year = [52.57 57.21 51.21]

Student Improvement committee will not have enough people to conduct spirit week after 2 years.

Question No. 11 continued

Scoring Rubric

<table>
<tr><th colspan="6">General Performance Indicators</th></tr>
<tr><th colspan="6">Level 1 - limited understanding</th></tr>
<tr><td colspan="3">1 mark
weak attempt, inappropriate strategy or no strategy
1 criterion correct</td><td colspan="3">2 marks
reasonable attempt, appropriate strategy with major errors or omissions
2 criteria correct</td></tr>
<tr><th colspan="6">Level 2 - good understanding</th></tr>
<tr><td colspan="2">3 marks
reasonable strategy, minor errors and/or omissions
3 criteria correct</td><td colspan="2">4 marks
sound strategy, mostly complete, minor errors
4 criteria correct</td><td colspan="2">5 marks
almost complete and correct
5 criteria correct</td></tr>
<tr><th colspan="6">Level 3 - exceptional understanding</th></tr>
<tr><td colspan="6">6 marks
complete and correct, reflecting exceptional understanding
6 criteria correct</td></tr>
</table>

Marker Notes:

- *No deduction if complements are missing in a).*
- *Maximum ½ mark deduction for each kind of technical communication error (incorrect use of brackets on matrices or not expressing transition matrices as decimals or percentages).*

Marking Key
1 mark for correct diagram in a) *1 mark for diagonal in b)* *1 mark for the rest of the matrix in b)* *1 mark for correct answer in c)* *1 mark for work shown indicating an appropriate strategy in d)* *1 mark for correct conclusion based on answer in d)*

Student exemplar 1

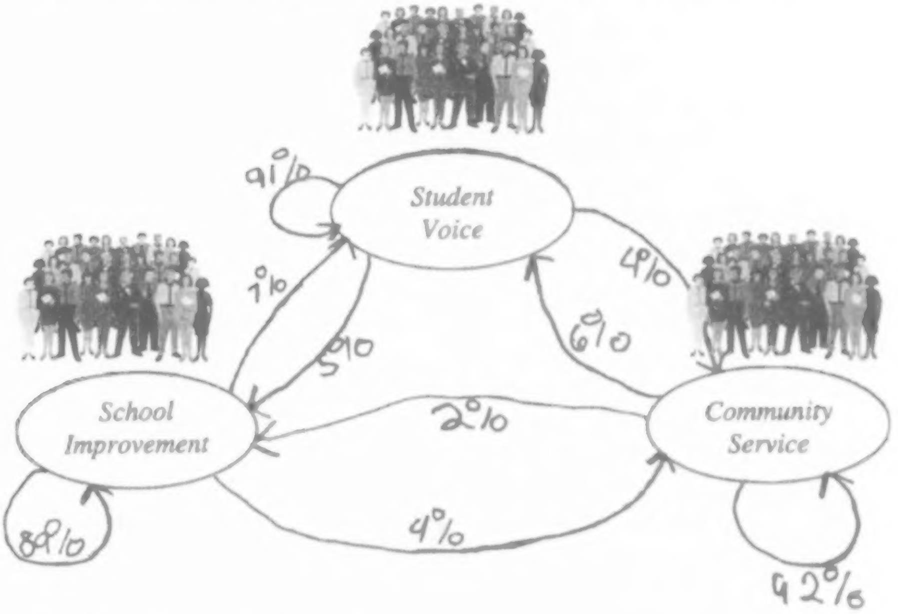
Total: 6 marks

At Plains High School, students are asked to join one school committee. Their choices include: *School Improvement*, *Student Voice* and *Community Service*. Students are allowed to change committees at the end of each school year. Below are the switching behaviours of the students.

- *School Improvement* loses 4% of it's members to *Community Service* and 7% to *Student Voice*.
- 5% of the *Student Voice* committee members join the *School Improvement* committee the next year and 4% become members of *Community Service*.
- 2% leave *Community Service* to become *School Improvement* members and 6% leave to join *Student Voice*.

a) Draw a transition diagram that illustrates this switching behaviour.

(1 mark)



b) Complete a transition matrix.

(2 marks)

$$\begin{array}{c|ccc} & SI & SV & CS \\ SI & .89 & .07 & .04 \\ SV & .05 & .91 & .04 \\ CS & .02 & .06 & 92 \end{array}$$

Student exemplar 1 continued

c) Last year's committee membership is shown in the matrix below:

$$\begin{array}{ccc} SI & SV & CS \\ \end{array}$$
$$\begin{bmatrix} 62 & 42 & 51 \end{bmatrix}$$

Using matrix operations, state the current membership of each committee.

(1 mark)

answer

$$\begin{bmatrix} 55.18 & 4.34 & 2.48 \\ 2.10 & 38.22 & 1.68 \\ .84 & 2.52 & 36.64 \end{bmatrix}$$

work

$$\begin{bmatrix} 62 \times .89 & 62 \times .07 & 62 \times .04 \\ 42 \times .05 & 42 \times .91 & 42 \times .04 \\ 51 \times .02 & 51 \times .06 & 51 \times .92 \end{bmatrix}$$

d) Every year the *School Improvement* committee has a Spirit Week which requires the help of 55 committee members. Use matrices to determine the future of this committee and of Spirit Week. Support your answer.

(2 marks)

$$\begin{array}{r} \text{committe} = 55.18 \\ 2.10 \\ \underline{.84} \\ 58.02 \end{array}$$

3 marks:

- 1 mark for diagram in a)
- 1 mark for diagonal in b)
- 1 mark for rest of matrix in b) (Note: 92 is trivial error)
- 0 marks for c) and d)

Student exemplar 2

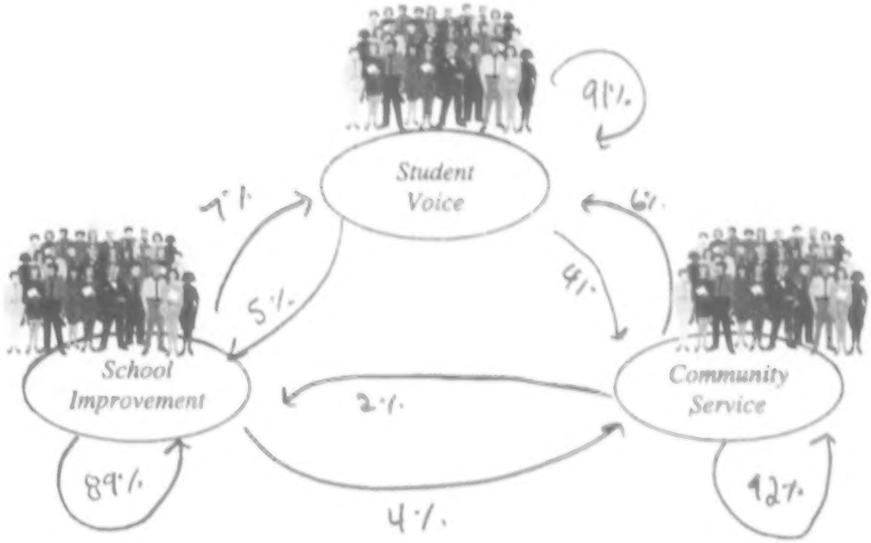
Total:
6 marks

At Plains High School, students are asked to join one school committee. Their choices include: *School Improvement*, *Student Voice* and *Community Service*. Students are allowed to change committees at the end of each school year. Below are the switching behaviours of the students.

- *School Improvement* loses 4% of it's members to *Community Service* and 7% to *Student Voice*.
- 5% of the *Student Voice* committee members join the *School Improvement* committee the next year and 4% become members of *Community Service*.
- 2% leave *Community Service* to become *School Improvement* members and 6% leave to join *Student Voice*.

a) Draw a transition diagram that illustrates this switching behaviour.

(1 mark)



b) Complete a transition matrix.

(2 marks)

$$T = \begin{array}{c} \\ SI \\ SV \\ CS \end{array} \begin{array}{c} \begin{array}{ccc} SI & SV & CS \end{array} \\ \begin{bmatrix} .89 & .07 & .04 \\ .05 & .91 & .04 \\ .02 & .06 & .92 \end{bmatrix} \end{array}$$

Student exemplar 2 continued

c) Last year's committee membership is shown in the matrix below:

$$\begin{array}{ccc} SI & SV & CS \\ \left[62\right. & 42 & \left.51\right] \end{array}$$

Using matrix operations, state the current membership of each committee.

(1 mark)

$$S = \begin{array}{ccc} SI & SV & CS \\ \left[62\right. & 42 & \left.51\right] \end{array}$$

$$[S] \times [T] = C = \begin{array}{ccc} SI & SV & CS \\ \left[58.3\right. & 45.62 & \left.51.08\right] \end{array}$$

you cannot have fractions of people, so therefore
current membership would be rounded to:

$$C = \begin{array}{ccc} SI & SV & SC \\ \left[58\right. & 46 & \left.51\right] \end{array}$$

d) Every year the *School Improvement* committee has a Spirit Week which requires the help of 55 committee members. Use matrices to determine the future of this committee and of Spirit Week. Support your answer.

(2 marks)

$$\underset{\substack{\uparrow \\ \text{(current members} \\ \text{(from above?)}}}{[C]} \times [T]$$

Next year the committees will have

$$N = \begin{array}{ccc} SI & SV & CS \\ \left[55\right. & 49 & \left.51\right] \end{array}$$

still enough for spirit week

$[N] \times [T] =$ 2 years from current

$$\begin{array}{ccc} SI & SV & CS \\ \left[52\right. & 57 & \left.51\right] \end{array}$$

There will not be enough committee members to organise
Spirit Week in 2 years.

6 marks:

- 1 mark for diagram in a)
- 1 mark for diagonal in b)
- 1 mark for rest of matrix in b)
- 1 mark for correct answer in c)
- 1 mark for strategy in d)
- 1 mark for conclusion in d)

Student exemplar 3

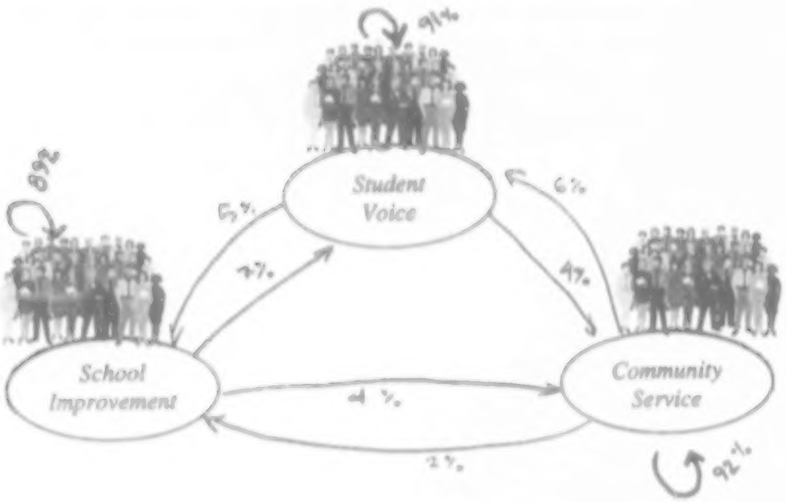
Total: 6 marks

At Plains High School, students are asked to join one school committee. Their choices include: *School Improvement*, *Student Voice* and *Community Service*. Students are allowed to change committees at the end of each school year. Below are the switching behaviours of the students.

- *School Improvement* loses 4% of it's members to *Community Service* and 7% to *Student Voice*.
- 5% of the *Student Voice* committee members join the *School Improvement* committee the next year and 4% become members of *Community Service*.
- 2% leave *Community Service* to become *School Improvement* members and 6% leave to join *Student Voice*.

a) Draw a transition diagram that illustrates this switching behaviour.

(1 mark)



b) Complete a transition matrix.

(2 marks)

$$\begin{array}{c|ccc} & SI & SV & CS \\ SI & 0 & 7\% & 4\% \\ SV & 5\% & 0 & 4\% \\ CS & 2\% & 6\% & 0 \end{array}$$

Student exemplar 3 continued

c) Last year's committee membership is shown in the matrix below:

$$\begin{array}{ccc} SI & SV & CS \\ [62 & 42 & 51] \end{array}$$

(1 mark)

Using matrix operations, state the current membership of each committee.

(assuming you round down,
cannot have fraction of person(s))

$$\begin{bmatrix} 65 & 49 & 55 \end{bmatrix}$$

d) Every year the *School Improvement* committee has a Spirit Week which requires the help of 55 committee members. Use matrices to determine the future of this committee and of Spirit Week. Support your answer.

(2 marks)

2 marks:

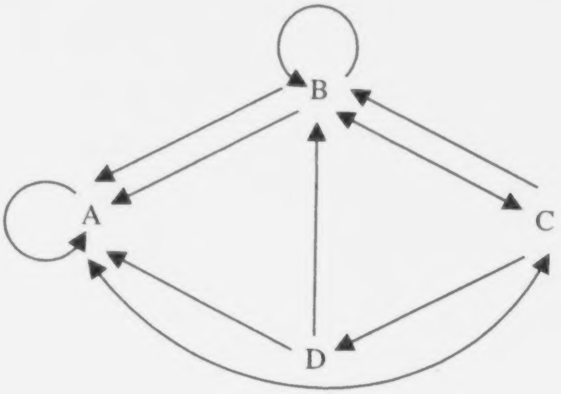
- 1 mark for diagram in a)
- 0 marks for diagonal in b)
- 1 mark for rest of matrix in b)
- 0 marks for c) and d)

Specific Outcomes: A1, A2 **Item Type: Restricted Response**

Question No. 12 and Answer

The diagram below shows a set of pathways that connects 4 communication devices. The arrows indicate the direction in which communication can take place.

Total:
3 marks



a) **Create a matrix to describe the communication pathways.**

(1 mark)

$$R = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 1 & 0 & 1 & 0 \\ 2 & 1 & 1 & 0 \\ 1 & 2 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

b) **Determine the matrix that represents the number of ways communication can occur from one communication device to another using exactly one relay.**

(1 mark)

$$R^2 = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 2 & 2 & 1 & 1 \\ 5 & 3 & 3 & 1 \\ 6 & 3 & 3 & 0 \\ 3 & 1 & 2 & 0 \end{bmatrix} \end{array}$$

Question No. 12 continued

c) **Show the matrix operations that you would perform to find the number of ways communication can occur from one device to another using at most two relays.**

(1 mark)

$$R + R^2 + R^3 = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 11 & 7 & 6 & 2 \\ 22 & 14 & 12 & 4 \\ 22 & 14 & 12 & 4 \\ 11 & 7 & 6 & 2 \end{bmatrix} \end{array}$$

Marker Notes:

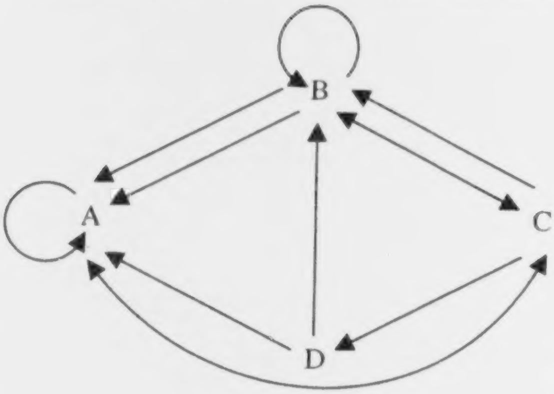
- *½ mark deduction if operation of R^2 is shown but not matrix in b).*
- *½ mark deduction if answer only is shown in c).*
- *Maximum ½ mark deduction for each kind of technical communication error (incorrect use of brackets on matrices or not expressing transition matrices as decimals or percentages).*

Marking Key
1 mark for correct matrix in a) *1 mark for correct matrix in b)* *1 mark for correct operations in c)*

Student exemplar 1

Total:
3 marks

The diagram below shows a set of pathways that connects 4 communication devices. The arrows indicate the direction in which communication can take place.



(1 mark)

a) Create a matrix to describe the communication pathways.

$$K = \begin{array}{c|cccc} & A & B & C & D \\ \hline A & 1 & 0 & 1 & 0 \\ B & 2 & 1 & 1 & 0 \\ C & 1 & 1 & 0 & 1 \\ D & 1 & 1 & 0 & 0 \end{array}$$

(1 mark)

b) Determine the matrix that represents the number of ways communication can occur from one communication device to another using **exactly** one relay.

$$K = \begin{array}{c|cccc} & A & B & C & D \\ \hline A & 1 & 0 & 1 & 0 \\ B & 2 & 1 & 1 & 0 \\ C & 1 & 1 & 0 & 1 \\ D & 1 & 1 & 0 & 0 \end{array}$$

(1 mark)

c) Show the matrix operations that you would perform to find the number of ways communication can occur from one device to another using **at most** two relays.

$K^2 =$ Than at most two relays

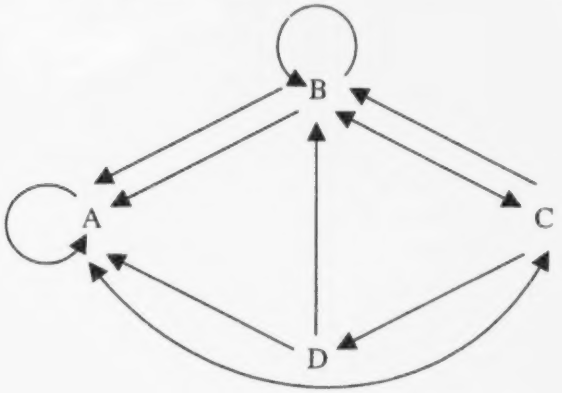
0 marks:

- 0 marks for a), b), and c)

Student exemplar 2

The diagram below shows a set of pathways that connects 4 communication devices. The arrows indicate the direction in which communication can take place.

Total:
3 marks



a) Create a matrix to describe the communication pathways.

(1 mark)

$$A = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 1 & 0 & 1 & 0 \\ 2 & 1 & 1 & 0 \\ 1 & 2 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

b) Determine the matrix that represents the number of ways communication can occur from one communication device to another using **exactly** one relay.

(1 mark)

$$A^2 = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 2 & 2 & 1 & 1 \\ 5 & 5 & 3 & 1 \\ 6 & 3 & 3 & 0 \\ 3 & 1 & 2 & 0 \end{bmatrix} \end{array}$$

Student exemplar 2 continued

c) Show the matrix operations that you would perform to find the number of ways communication can occur from one device to another using **at most** two relays.

(1 mark)

THE MATRIX OPERATION THAT YOU WOULD PERFORM TO FIND THE NUMBER OF WAYS COMMUNICATION CAN OCCUR FROM ONE DEVICE TO ANOTHER USING AT MOST TWO RELAYS IS : A^3

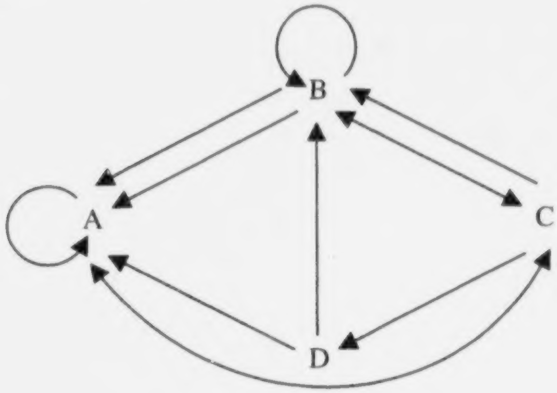
2 marks:

- 1 mark for a)
- 1 mark for b) (Note: cell 22 is trivial error)
- 0 marks for c)

Student exemplar 3

The diagram below shows a set of pathways that connects 4 communication devices. The arrows indicate the direction in which communication can take place.

Total:
3 marks



a) Create a matrix to describe the communication pathways.

(1 mark)

$$A = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{pmatrix} 1 & 0 & 1 & 0 \\ 2 & 1 & 1 & 0 \\ 1 & 2 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{pmatrix} \end{array}$$

b) Determine the matrix that represents the number of ways communication can occur from one communication device to another using **exactly** one relay.

(1 mark)

$$A^2 = \begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{pmatrix} 2 & 2 & 1 & 1 \\ 5 & 3 & 3 & 1 \\ 6 & 3 & 3 & 0 \\ 3 & 1 & 2 & 0 \end{pmatrix} \end{array}$$

Student exemplar 3 continued

c) Show the matrix operations that you would perform to find the number of ways communication can occur from one device to another using **at most** two relays.

(1 mark)

$$A + A^2 + A^3 = \begin{array}{c|cccc} & A & B & C & D \\ \hline A & 11 & 7 & 6 & 2 \\ B & 22 & 14 & 12 & 4 \\ C & 22 & 14 & 12 & 4 \\ D & 11 & 7 & 6 & 2 \end{array}$$

3 marks:

- 3 marks complete and correct

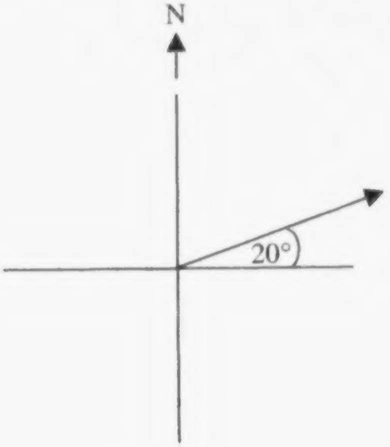
Specific Outcomes: B1 **Item Type: Restricted Response**

Question No. 13 and Answer

Total:
2 marks

The vector diagram below provides information about a wind. Use this information to determine the magnitude and the direction of the wind.

1 cm = 10 km/hr



The wind is blowing at 32 km/hr in the direction of E 20° N or 70° E of N or bearing of 70°.

Marker Notes:

- *Maximum ½ mark deduction for each kind of technical communication error (missing more than one vector head in a response or not stating a scale when using a scale diagram as a strategy).*

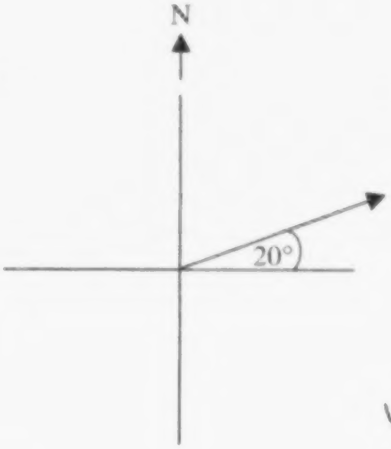
Marking Key
1 mark for correct direction
1 mark for correct magnitude ± 3 km/hr

Student exemplar 1

Total: 2 marks

The vector diagram below provides information about a wind. Use this information to determine the magnitude and the direction of the wind.

1 cm = 10 km/hr



the wind is blowing 20°north of east.
with a speed of 10 km/hr.

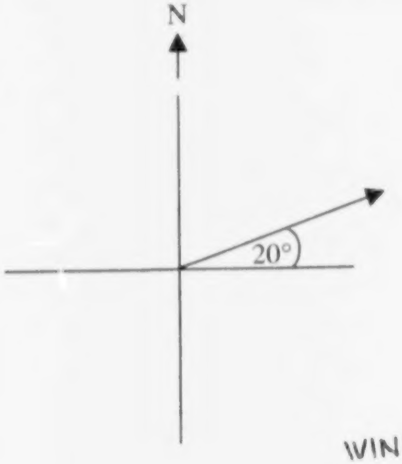
1 mark:
- 1 mark for direction
- 0 marks for magnitude

Student exemplar 2

The vector diagram below provides information about a wind. Use this information to determine the magnitude and the direction of the wind.

Total:
2 marks

1 cm = 10 km/hr



WIND BLOWS
20° WEST OF NORTH
WITH A SPEED OF
30 km/hr

1 mark:

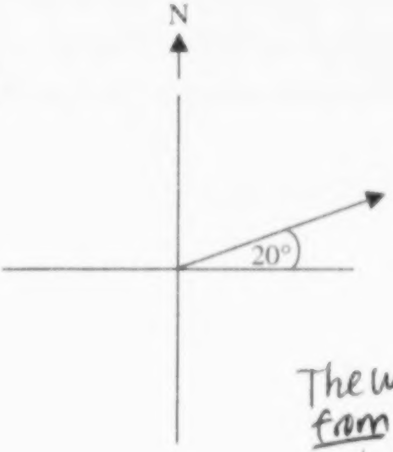
- 1 mark for magnitude
- 0 marks for direction

Student exemplar 3

Total:
2 marks

The vector diagram below provides information about a wind. Use this information to determine the magnitude and the direction of the wind.

1 cm = 10 km/hr



The wind is coming
from a sw direction
at a bearing of
20°
By measuring the
length of the line
you can figure out
the wind's velocity.
The line is 3.3 cm long so
the wind is travelling at
a speed of 30.3 km/hr.

1 mark:
- 1 mark for magnitude
- 0 marks for direction

Specific Outcomes: B2, B3 **Item Type: Restricted Response with Explanation**

Question No. 14 and Answer

Total:
2 marks

After her parachute opens, a skydiver falls toward the earth at an average rate of 4.7 m/sec. During her jump a wind pushes her at a horizontal rate of 1.1 m/sec.

What is the skydiver's resultant direction? Indicate how you arrived at your answer.

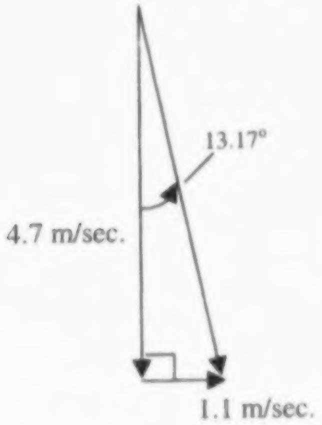
Resultant is 4.8 m/sec at 13.17° from vertical

OR

Resultant is S 13.17° E

OR

Resultant is S 13.17° W



Marker Notes:

- *Maximum ½ mark deduction for each kind of technical communication error (missing more than one vector head in a response or not stating a scale when using a scale diagram as a strategy).*

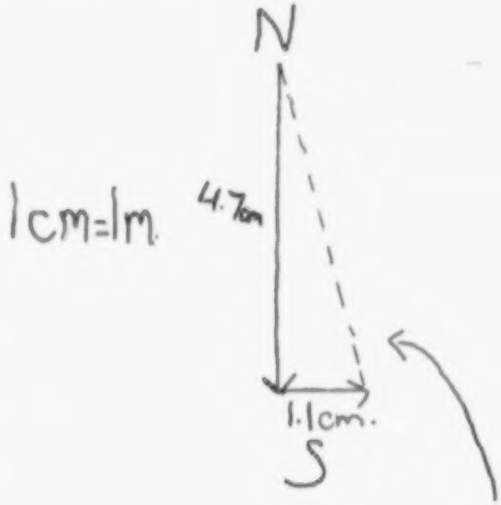
Marking Key
1 mark for direction *1 mark for work shown indicating an appropriate strategy*

Student exemplar 1

After her parachute opens, a skydiver falls toward the earth at an average rate of 4.7 m/sec. During her jump a wind pushes her at a horizontal rate of 1.1 m/sec.

Total:
2 marks

What is the skydiver's resultant direction? Indicate how you arrived at your answer.



75° S of E

$$c^2 = a^2 + b^2$$
$$= 4.7^2 + 1.1^2$$
$$c^2 = \sqrt{23.3}$$
$$c = \underline{4.8 \text{m/sec}}$$

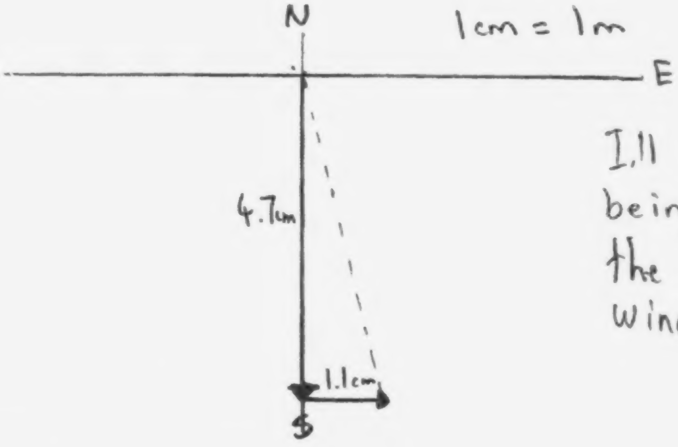
2 marks:
- 2 marks correct and complete

Student exemplar 2

Total:
2 marks

After her parachute opens, a skydiver falls toward the earth at an average rate of 4.7 m/sec. During her jump a wind pushes her at a horizontal rate of 1.1 m/sec.

What is the skydiver's resultant direction? Indicate how you arrived at your answer.



I.ll assume she's being pushed from the west by the wind.

5 m/sec

S 75°E

I drew a resultant line, and came up withe the angle and the distance.

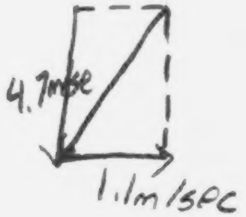
1 mark:
- 1 mark for strategy
- 0 marks for resultant (should be E 75° S)

Student exemplar 3

Total:
2 marks

After her parachute opens, a skydiver falls toward the earth at an average rate of 4.7 m/sec. During her jump a wind pushes her at a horizontal rate of 1.1 m/sec.

What is the skydiver's resultant direction? Indicate how you arrived at your answer.



2.90 m/sec in whatever direct the wind is blowing.

0 marks:
- 0 marks for direction
- 0 marks for strategy (no scale, no work shown)

Specific Outcomes: B2 **Item Type: Restricted Response with Explanation**

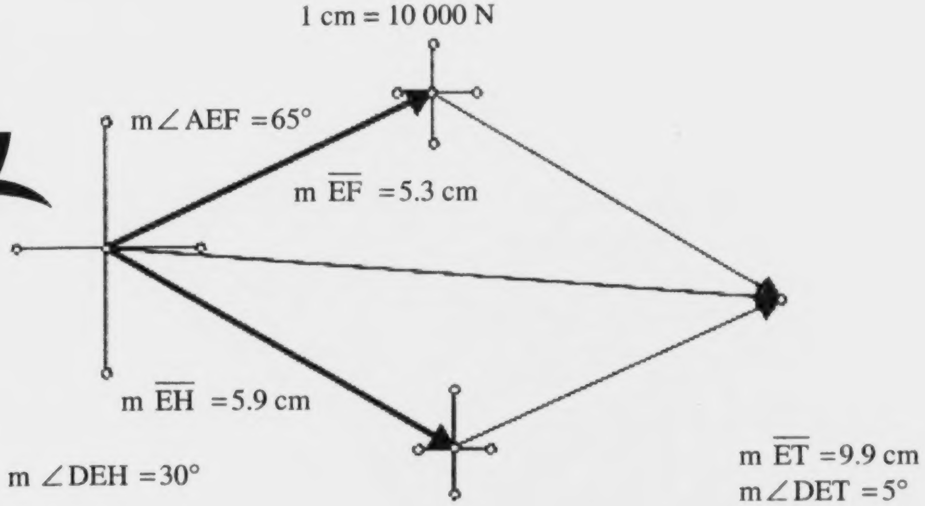
Question No. 15 and Answer

Total:
4 marks

An oil tanker has become stranded off the coast of Canada. Two tugboats have been sent to pull the ship to shore. One tugboat will pull with a force of 53 000 N at a bearing of 65°, while the other will pull with a force of 59 000 N at a bearing of 120°.

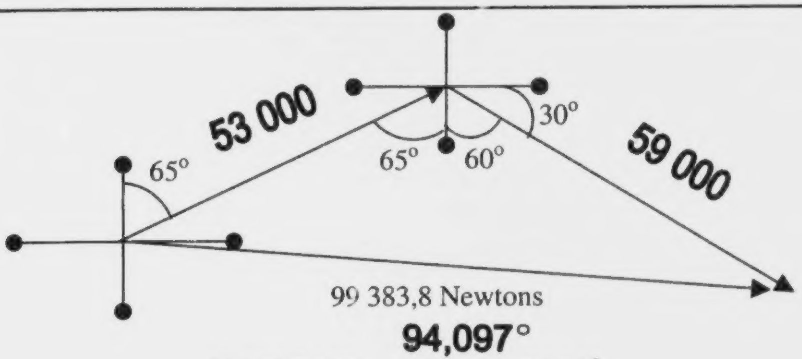
(2 marks) **a)** **Provide a complete, labelled vector diagram to illustrate this situation.**

(2 marks) **b)** **A force of 95 000 N is required to move the oil tanker. Determine the direction the tanker would move, and determine whether these two tugboats are able to pull the tanker to shore. Justify your answer.**


1 cm = 10 000 N
m∠AEF =65°
m EF =5.3 cm
m EH =5.9 cm
m ∠DEH =30°
m ET =9.9 cm
m∠DET =5°

The two tugboats are able to move the tanker as the resultant pull is 99 384 N on a bearing of 94.1°.

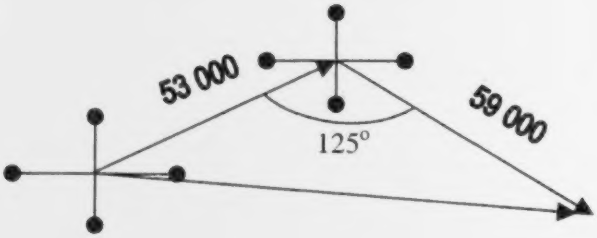
OR


53 000
59 000
65°
65°
60°
30°
99 383,8 Newtons
94,097°

99 383.84 N. at a bearing of 94.1°

Question No. 15 continued

$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$= (53000)^2 + (59000)^2 - 2(53000)(59000)(\cos 125)$$
$$= 99383.84N.$$



Marker Notes:

- *Maximum ½ mark deduction for each kind of technical communication error (missing more than one vector head in a response or not stating a scale when using a scale diagram as a strategy).*
- ***± 3 mm, ± 3°***

Marking Key
1 mark for correct vector diagram in a)
1 mark for work shown indicating an appropriate strategy in a)
1 mark for supported explanation in b)
1 mark for correct direction in b)

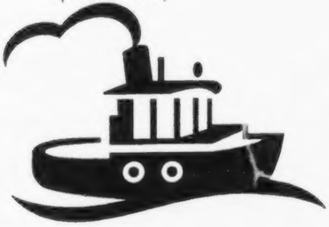
Student exemplar 1

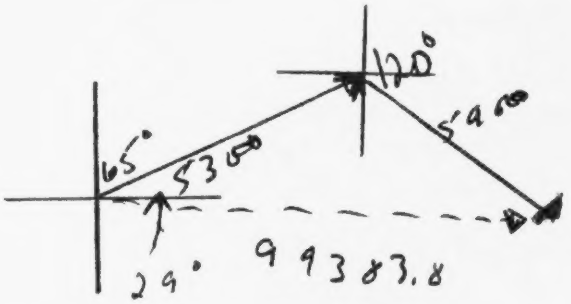
Total:
4 marks

An oil tanker has become stranded off the coast of Canada. Two tugboats have been sent to pull the ship to shore. One tugboat will pull with a force of 53 000 N at a bearing of 65°, while the other will pull with a force of 59 000 N at a bearing of 120°.

a) Provide a complete, labelled vector diagram to illustrate this situation.

(2 marks)





b) A force of 95 000 N is required to move the oil tanker. Determine the direction the tanker would move, and determine whether these two tugboats are able to pull the tanker to shore. Justify your answer.

(2 marks)

65+29= 94°

I used trisolve to find side 99383.8 N
∠ 29°

The tanker would move at 94°(bearing) at
99383.8 N.

3 marks:

- 1 mark for correct diagram in a)
- 1 mark for strategy
- 1 mark for correct direction in b)
- 0 marks for missing explanation

Student exemplar 2

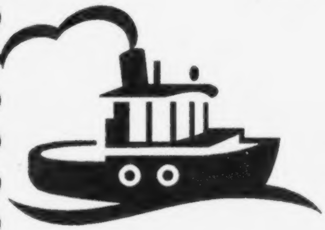
Total: 4 marks

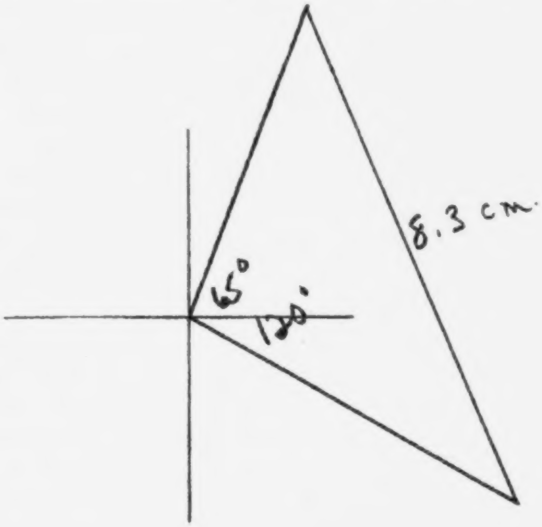
An oil tanker has become stranded off the coast of Canada. Two tugboats have been sent to pull the ship to shore. One tugboat will pull with a force of 53 000 N at a bearing of 65°, while the other will pull with a force of 59 000 N at a bearing of 120°.

a) Provide a complete, labelled vector diagram to illustrate this situation.

(2 marks)

1000
1 = [illegible]





b) A force of 95 000 N is required to move the oil tanker. Determine the direction the tanker would move, and determine whether these two tugboats are able to pull the tanker to shore. Justify your answer.

(2 marks)

The tanker would move 83000 newtns
No it will not be able to pull the
tanker because it is going the wrong direction.

0 marks:
- 0 marks for diagram (angles are wrong)
- 0 marks for strategy
- 0 marks for direction
- 0 marks for explanation because it's not based on magnitude

Student exemplar 3

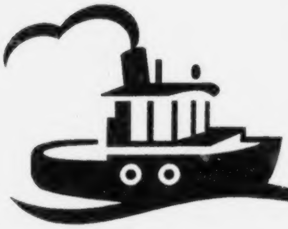
Total:
4 marks

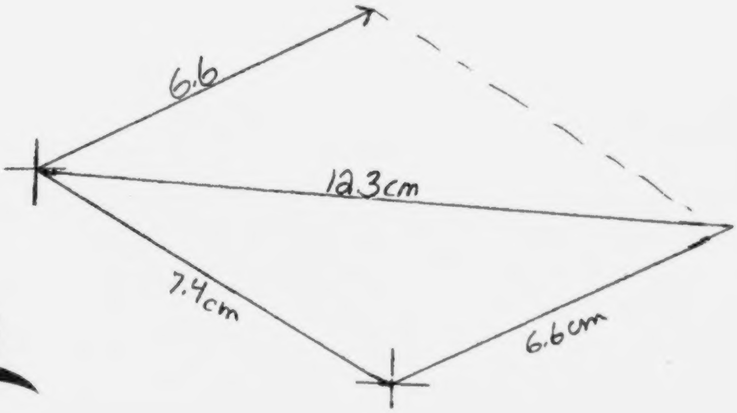
An oil tanker has become stranded off the coast of Canada. Two tugboats have been sent to pull the ship to shore. One tugboat will pull with a force of 53 000 N at a bearing of 65°, while the other will pull with a force of 59 000 N at a bearing of 120°.

a) Provide a complete, labelled vector diagram to illustrate this situation.

(2 marks)

1cm = 8000N





b) A force of 95 000 N is required to move the oil tanker. Determine the direction the tanker would move, and determine whether these two tugboats are able to pull the tanker to shore. Justify your answer.

(2 marks)

The resultant's magnitude is 98400
at a bearing of 94°

2 ½ marks:

- 1 mark for diagram
- 1 mark for strategy
- 1 mark for correct direction
- 0 marks for explanation
- -½ mark for missing arrowheads

Specific Outcomes: D2 **Item Type: Restricted Response**

Question No. 16 and Answer

From a class of 30 students, 5 will be selected to attend a student conference.

Total:
2 marks

a) **How many different groups of five can be picked?**

(1 mark)

$$\frac{30 \cdot 29 \cdot 28 \cdot 27 \cdot 26}{5!} = 142\ 506$$

OR

$${}_{30}C_5 = 142\ 506 \text{ groups of } 5$$

b) **After 5 students are selected, each is assigned a different responsibility. In how many ways can the responsibilities be assigned to these 5 students?**

(1 mark)

$$5! = 120 \text{ ways}$$

Marking Key
1 mark for correct answer in a) *1 mark for correct answer in b)*

Student exemplar 1

From a class of 30 students, 5 will be selected to attend a student conference.

Total:
2 marks

(1 mark) a) How many different groups of five can be picked?

$30C5 = \boxed{142506}$

(1 mark) b) After 5 students are selected, each is assigned a different responsibility. In how many ways can the responsibilities be assigned to these 5 students?

$5 \cdot 5 = 25$

There are 25 ways that these responsibilities can be assigned.

1 mark:
- 1 mark for correct answer in a)
- 0 marks for b)

Student exemplar 2

Total:
2 marks

From a class of 30 students, 5 will be selected to attend a student conference.

(1 mark)

a) How many different groups of five can be picked?

142 506 different groups

30 nCr 5 =

(1 mark)

b) After 5 students are selected, each is assigned a different responsibility. In how many ways can the responsibilities be assigned to these 5 students?

5 nPr 5 =

120 ways

2 marks:

- 2 marks correct and complete

Student exemplar 3

From a class of 30 students, 5 will be selected to attend a student conference.

Total:
2 marks

a) How many different groups of five can be picked?

(1 mark)

$\underline{30} + \underline{29} + \underline{28} + \underline{27} + \underline{26}$ = 140 different ways five people could be picked.

b) After 5 students are selected, each is assigned a different responsibility In how many ways can the responsibilities be assigned to these 5 students?

(1 mark)

$\underline{5}\ \underline{4}\ \underline{3}\ \underline{2}\ \underline{1}$ = 15 different ways

0 marks:

- 0 marks for a) and b)

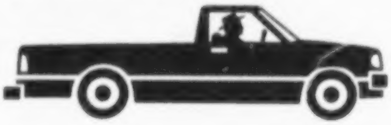
Specific Outcomes: D4, D5 **Item Type: Restricted Response**

Question No. 17 and Answer

Bill wishes to purchase a new truck. He must make the following choices:

Total:
3 marks

- **colour: red, green, blue or white**
- **CD player: yes or no**
- **transmission: standard or automatic**



Assume there is an equal probability for each choice.

a) **What is the probability that he will choose a truck that has standard transmission and is red?**

(1 mark)

$$0.5 \times 0.25 = 0.125 \text{ or } 1/8$$

b) **What is the probability that he will choose a truck that has an automatic transmission and a CD player, and is either green or white?**

(1 mark)

$$(0.25 + 0.25) \times 0.5 \times 0.5 = 0.125 \text{ or } 1/8$$

c) **What is the probability that a truck has a CD player or automatic transmission?**

(1 mark)

$$(0.5 + 0.5) - (0.5 \times 0.5)$$
$$1 - 0.25$$
$$0.75$$

Marking Key
1 mark for correct answer in a)
1 mark for correct answer in b)
1 mark for correct answer in c)

Student exemplar 1

Bill wishes to purchase a new truck. He must make the following choices:

Total:
3 marks

- **colour**: red, green, blue or white
- **CD player**: yes or no
- **transmission**: standard or automatic

Assume there is an equal probability for each choice.

a) What is the probability that he will choose a truck that has standard transmission and is red?

(1 mark)

prob (st.) = $1/2$
prob (red) = $1/4$
P(red & standard) = $(1/2)(1/4) = .125 = .13$

b) What is the probability that he will choose a truck that has an automatic transmission and a CD player, and is either green or white?

(1 mark)

P(G or W) = $1/2$
P(AT) = $1/2$
P(CD) = $1/2$
P(G or W & AT & CD) = $(1/2)(1/2)(1/2) = .125 = .13$

c) What is the probability that a truck has a CD player or automatic transmission?

(1 mark)

~~P(CD or AT) = 8~~

P(CD or AT) = $1/2 + 1/2 = 1.00$

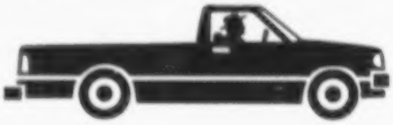
2 marks:
- 1 mark for a)
- 1 mark for b)
- 0 marks for c)

Student exemplar 2

Bill wishes to purchase a new truck. He must make the following choices:

Total:
3 marks

- **colour**: red, green, blue or white
- **CD player**: yes or no
- **transmission**: standard or automatic

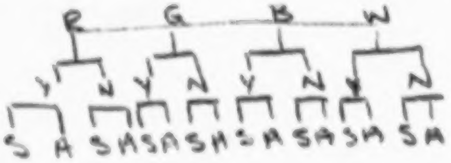


Assume there is an equal probability for each choice.

a) What is the probability that he will choose a truck that has standard transmission and is red?

(1 mark)

$P(S+R) = \frac{2}{16} = \frac{1}{8}$



b) What is the probability that he will choose a truck that has an automatic transmission and a CD player, and is either green or white?

(1 mark)

$P(G/W+A+CD) = \frac{2}{16} = \frac{1}{8}$

c) What is the probability that a truck has a CD player or automatic transmission?

(1 mark)

$P(CD \text{ or } A) = \frac{3}{4}$

3 marks:

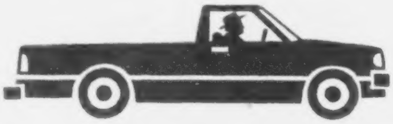
- 3 marks correct and complete

Student exemplar 3

Bill wishes to purchase a new truck. He must make the following choices:

Total:
3 marks

- **colour**: red, green, blue or white
- **CD player**: yes or no
- **transmission**: standard or automatic



Assume there is an equal probability for each choice.

a) What is the probability that he will choose a truck that has standard transmission and is red?

(1 mark)

$$\frac{1}{2} + \frac{1}{4} = \frac{2}{6} = \frac{1}{3}$$

b) What is the probability that he will choose a truck that has an automatic transmission and a CD player, and is either green or white?

(1 mark)

$$\frac{2}{4} \quad \frac{1}{2} + \frac{1}{2} = \frac{4}{8} = \frac{1}{2}$$

c) What is the probability that a truck has a CD player or automatic transmission?

(1 mark)

$$P(\bar{A}) \quad \frac{3}{4} + \frac{1}{2} + \frac{1}{2} = \frac{5}{8}$$

ALL COLOURS   CD PLAYER   STANDARD

$$P(A) = 1 - P(A)$$

$$1 - 5/8$$

$$= 3/8$$

0 marks:

- 0 marks for a), b) and c)

Specific Outcomes: D3, D4 **Item Type: Restricted Response with Explanation**

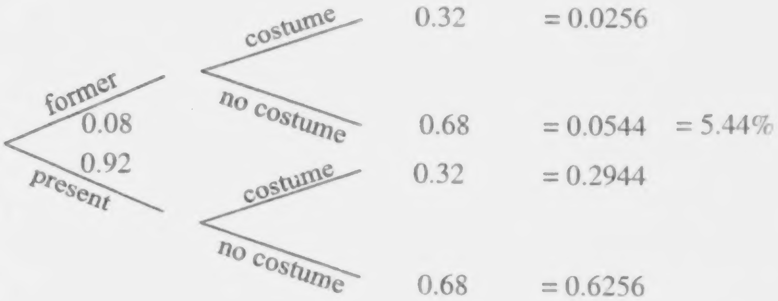
Question No. 18 and Answer

Total:
3 marks

Eight percent of students attending a Hallowe'en dance are former students, while the others are currently enrolled. Thirty-two percent of those attending wear costumes.

a) **Create a sample space to determine the probability that a randomly selected student is a former student not in costume.**

(2 marks)


former
0.08
0.92
present
costume
no costume
costume
no costume
0.32 = 0.0256
0.68 = 0.0544 = 5.44%
0.32 = 0.2944
0.68 = 0.6256

P = 5.44%

b) **If 200 people attend the dance, how many former students are not in costume?**

(1 mark)

5.44 × 200 = 10.88 or 11 former students

Marking Key
1 mark for sample space in a)
1 mark for correct answer in a)
1 mark for correct answer in b)

Student exemplar 1

Eight percent of students attending a Hallowe'en dance are former students, while the others are currently enrolled. Thirty-two percent of those attending wear costumes.

Total: 3 marks

a) Create a sample space to determine the probability that a randomly selected student is a former student not in costume.

(2 marks)

Say there were 100 students

$$\frac{8}{100} \cdot \frac{68}{100} = \frac{544}{10000} \simeq \frac{5.44}{100}$$

b) If 200 people attend the dance, how many former students are not in costume?

(1 mark)

$200 \times .32 = 64$

$\therefore$ 64 students wore costumes.

1 mark:
- 0 marks for sample space
- 1 mark for answer in a)
- 0 marks for b)

Student exemplar 2

Eight percent of students attending a Hallowe'en dance are former students, while the others are currently enrolled. Thirty-two percent of those attending wear costumes.

Total: 3 marks

a) Create a sample space to determine the probability that a randomly selected student is a former student not in costume.

(2 marks)

8 - old } 32 incostume
92 current }

.08 × .68 = .0544 ×100 = 5.44%

students

8% former　92% current

costumes

.32 yes　.68 no

b) If 200 people attend the dance, how many former students are not in costume?

(1 mark)

.08 × .68 = 5.44 %

200 × .0544 = 10.88 people again
you can't have .88 of a person so it
would have to be 12

3 marks:
- 1 mark for sample space
- 1 mark for answer in a)
- 1 mark for answer in b)

Student exemplar 3

Eight percent of students attending a Hallowe'en dance are former students, while the others are currently enrolled. Thirty-two percent of those attending wear costumes.

Total: 3 marks

a) Create a sample space to determine the probability that a randomly selected student is a former student not in costume.

(2 marks)

8% former

92% curren

32% wor

68 didn't

.08

32% 68%

.92

32% 68%.

b) If 200 people attend the dance, how many former students are not in costume?

(1 mark)

125 students

200 × 92% = 184 × 68% = 125

1 mark:

- 1 mark for sample space
- 0 mark for answer in a)
- 0 marks for answer b)

Specific Outcomes: E3 **Item Type: Restricted Response with Explanation**

Question No. 19 and Answer

Based on past surveys, an average of 445 out of 500 hockey players like their coaches, with a standard deviation of 7.

Total: 3 marks

a) **Calculate a 95% confidence interval for the percent of hockey players who like their coaches. Support your answer.**

(2 marks)

(0.8626, 0.9174) or (86%, 92%) = C 95%

1-Prop Z int.	Prop Z int.
x : 445	(0.86257; 0.91743)
n : 500	P = 0.89
Clevel : 95	n = 500

b) **Explain the meaning of the confidence interval in relation to hockey coaches.**

(1 mark)

There is a 95% chance that between 86% and 92% of players like their coach.

OR

With 95% certainty or 19 times out of 20, the number of players out of 500 who like their coaches will fall between 431.3 and 458.7.

Marking Key
1 mark for work shown indicating an appropriate strategy in a)
1 mark for correct answer in a)
1 mark for correct answer in b)

Student exemplar 1

Based on past surveys, an average of 445 out of 500 hockey players like their coaches, with a standard deviation of 7.

Total:
3 marks

a) Calculate a 95% confidence interval for the percent of hockey players who like their coaches. Support your answer.

(2 marks)

Prop Z-int = x = 445
n = 500
clevel = .95

(.86257, .91743)
x500 x500
(431.29, 458.72)

b) Explain the meaning of the confidence interval in relation to hockey coaches.

(1 mark)

This shows that alot of hockey players like their coachos.

2 marks:

- 1 mark for strategy
- 1 mark for answer in a)
- 0 marks for b)

Student exemplar 2

Based on past surveys, an average of 445 out of 500 hockey players like their coaches, with a standard deviation of 7.

Total:
3 marks

a) Calculate a 95% confidence interval for the percent of hockey players who like their coaches. Support your answer.

(2 marks)

$\frac{445}{500} = .89$

x: 7
n: 445
c-Level 95

$= [.00417, .02729]$
$\times 445$
$= [1.86, 12.14]$

b) Explain the meaning of the confidence interval in relation to hockey coaches.

(1 mark)

The meaning of the confidence interval in relation to hockey coaches is to see 95% of their players like them.

0 marks:

- 0 marks for a)
- 0 marks for strategy (Prop Z int. used wrong)
- 0 marks for answer in b)

Student exemplar 3

Based on past surveys, an average of 445 out of 500 hockey players like their coaches, with a standard deviation of 7.

Total:
3 marks

a) Calculate a 95% confidence interval for the percent of hockey players who like their coaches. Support your answer.

(2 marks)

$\mu = \frac{445}{500} = .89$ $\sigma = \frac{7}{500} = .014$

95% off a sample is within 1.96 st deviations.

So, upper limit $= \mu + (-z) \Rightarrow .89 + (1.96 \times .014) = .91.74$

Lower limit $= .89 + (-1.96 \times .014) = .8626$ so,

with a 95% confidence interval between 86.26% and 91.74% of players will like their coachs.

b) Explain the meaning of the confidence interval in relation to hockey coaches.

(1 mark)

A confidence interval in this case means that 95% of time groups polled will result in between 86.25% and 91.74% players liking their coachs.

3 marks:
- 3 marks correct and complete

Question No. 20 and Answer

Total:
6 marks

A local modelling agency hires males who are 168 – 195 cm in height, and females who are 158 – 186 cm in height. The heights of males and females in this area are normally distributed with a mean and standard deviation as follows:

	$\overline{x}$	σ
Males	**176 cm**	**7**
Females	**163 cm**	**8**

a) **Calculate the percentage of males who would not qualify for employment with this agency because they are too tall. Support your answer.**

(2 marks)

$$z\text{-score } 195 = \frac{195-176}{7} = 2.714$$

Using the z-score table, 0.34% of men will not qualify because they are too tall.

OR

TI-83 or computer solution accepted - will get 0.33 using shade norm

b) **The agency claims that both males and females have an equal chance of being hired. Use statistics to prove or disprove their claim. Support your answer.**

(2 marks)

Men z-score: $168 = -1.14$
$195 = 2.71$

Women z-score: $158 = -0.625$
$186 = 2.875$

No because men are included in a much wider range of z-scores (3.85) while women only range 3.5.

shade norm (168, 195, 176, 7) = 87% men
(158, 186, 163, 8) = 73.2% women

OR

Yes because more shorter men are taken but more taller women are included.

OR

Other answers accepted.

Question No. 20 continued

c) **The agency wishes to change its criteria so that the tallest 84% of women qualify for employment. What is the new minimum height requirement for women? Support your answer.**

(2 marks)

84% = z-score of –1

$$-1 = \frac{x - 163}{8}$$

x = 155 cm is new minimum height

inv norm (0.16, 163, 8) = 155.04 cm

OR

Computer generated answers accepted.

Scoring Rubric

General Performance Indicators		
Level 1 - limited understanding		
1 mark **weak attempt, inappropriate strategy or no strategy** 1 criterion correct	**2 marks** **reasonable attempt, appropriate strategy with major errors or omissions** 2 criteria correct	
Level 2 - good understanding		
3 marks **reasonable strategy, minor errors and/or omissions** 3 criteria correct	**4 marks** **sound strategy, mostly complete, minor errors** 4 criteria correct	**5 marks** **almost complete and correct** 5 criteria correct
Level 3 - exceptional understanding		
6 marks **complete and correct, reflecting exceptional understanding** 6 criteria correct		

Marking Key
1 mark for work shown indicating an appropriate strategy in a) *1 mark for correct answer in a)* *1 mark for support in b)* *1 mark for conclusion based on support in b)* *1 mark for correct answer in c)* *1 mark for support in c)*

Student exemplar 1

Total:
6 marks

A local modelling agency hires males who are 168 – 195 cm in height, and females who are 158 – 186 cm in height. The heights of males and females in this area are normally distributed with a mean and standard deviation as follows:

	$\bar{x}$	σ
Males	176 cm	7
Females	163 cm	8

a) Calculate the percentage of males who would not qualify for employment with this agency because they are too tall. Support your answer.

(2 marks)

1 − normal cdf=(168,195,176,7)

= 0.13 = 13%

b) The agency claims that both males and females have an equal chance of being hired. Use statistics to prove or disprove their claim. Support your answer.

(2 marks)

males= normalcdf(168,195,176,7)=0.87 = 87%

females = normal cdf(158,186,163,8)=0.73=73%

87% of males are admitted, 73% of females are admitted.

c) The agency wishes to change its criteria so that the tallest 84% of women qualify for employment. What is the new minimum height requirement for women? Support your answer.

(2 marks)

84% σ=1 =

163 − 8 = 155 cm

4 marks:
- 0 marks for a)
- 1 mark for support in b)
- 1 mark for conclusion in b)
- 1 mark for strategy in c)
- 1 mark for answer in c)

Student exemplar 2

Total:
6 marks

A local modelling agency hires males who are 168 – 195 cm in height, and females who are 158 – 186 cm in height. The heights of males and females in this area are normally distributed with a mean and standard deviation as follows:

	$\bar{x}$	σ
Males	176 cm	7
Females	163 cm	8

a) Calculate the percentage of males who would not qualify for employment with this agency because they are too tall. Support your answer.

(2 marks)

Normalcdf (168,195,176,7) = 87% successful

100% - 87% = 13% of male who would not qualify for employment.

b) The agency claims that both males and females have an equal chance of being hired. Use statistics to prove or disprove their claim. Support your answer.

(2 marks)

Females normalcdf (158,186,163,8) = 73%

The agency claims are wrong since they hire 14% of men more.

c) The agency wishes to change its criteria so that the tallest 84% of women qualify for employment. What is the new minimum height requirement for women? Support your answer.

(2 marks)

InvNorm (.84,163,8) = 171 is the new minimum height requirement for women.

2 marks:
- 0 marks for a)
- 1 mark for answer in b)
- 1 mark for support in b)
- 0 marks for c)

Student exemplar 3

Total:
6 marks

A local modelling agency hires males who are 168 – 195 cm in height, and females who are 158 – 186 cm in height. The heights of males and females in this area are normally distributed with a mean and standard deviation as follows:

	$\overline{x}$	σ
Males	176 cm	7
Females	163 cm	8

a) Calculate the percentage of males who would not qualify for employment with this agency because they are too tall. Support your answer.

(2 marks)

normal cdf (195, E99, 176, 7) = .0053

So .33% would not qualify.

b) The agency claims that both males and females have an equal chance of being hired. Use statistics to prove or disprove their claim. Support your answer.

(2 marks)

normal cdf (168, 195, 176, 7) = 87%
of males falls
between their standards

normal (158, 186, 163, 8) = 73%
of females
fall between their
standards

Their pretty close in being far
but they should be 100%

c) The agency wishes to change its criteria so that the tallest 84% of women qualify for employment. What is the new minimum height requirement for women? Support your answer.

(2 marks)

inv Norm (.14, 163, 8) = 155 is the new
minimum height

6 marks:

- 6 marks correct and complete

Specific Outcomes: G1, G3 **Item Type: Open Response**

Question No. 21 and Answer

Total: 4 marks

Two business partners, Mr. Smith and Mr. Jones, have consulted biorhythm graphs to determine the ideal and most appropriate time to conduct the grand opening of their new store. Their personalized biorhythm graphs show how their energy levels fluctuate during the day and correspond to the equations below:

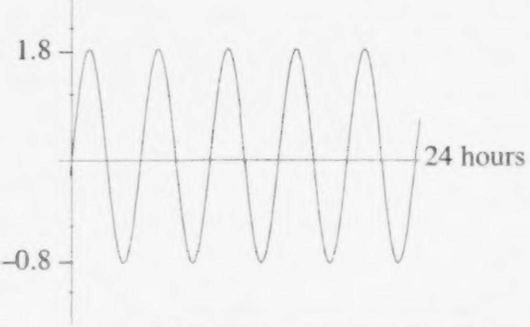
Mr. Smith: $E = 1.3 \sin(1.3t) + 0.5$
Mr. Jones: $E = 1.3 \sin(1.87t) + 0.5$

Time in hours is measured on the horizontal axis, and energy level is measured on the vertical axis.

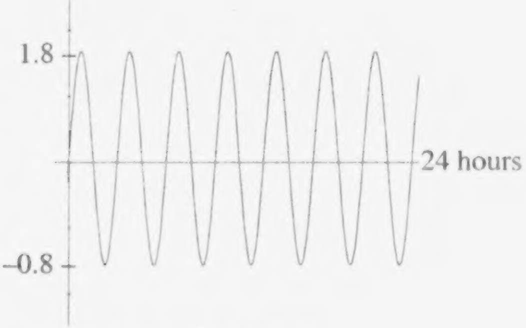
a) **If $t = 0$ at midnight, at what time of day should they hold their grand opening? Use their biorhythm graphs to explain why.**

(2 marks)

Smith:



Jones:



Both men have maximums at 1:00 a.m., 11:00 a.m. and 9:00 p.m. They should open the store at 11:00 a.m. since they will both be at peak energy level and customers will come in at 11:00 a.m. more than at 1:00 a.m. or 9:00 p.m.

b) **Identify the period of the equation of Mr. Jones's biorhythm. Explain what this period means by comparing it with Mr. Smith's biorhythm.**

(2 marks)

$$\text{Jones: } \frac{6.28}{1.87} = 3.36 \text{ hours}$$

Jones has 3.4 hours between maximum energy levels.
Smith has more time between maximum energy levels.

OR

Mr. Jones' mood swings more than Mr. Smith's.

Question No. 21 continued

Scoring Rubric

<table>
<tr><th colspan="2">General Performance Indicators</th></tr>
<tr><td colspan="2">Level 1 - limited understanding</td></tr>
<tr><td colspan="2">1 mark
weak attempt, inappropriate strategy or no strategy
1 criterion correct</td></tr>
<tr><td colspan="2">Level 2 - good understanding</td></tr>
<tr><td>2 marks
reasonable attempt, appropriate strategy, minor errors and/or omissions
2 criteria correct</td><td>3 marks
complete and correct with minor errors
3 criteria correct</td></tr>
<tr><td colspan="2">Level 3 - exceptional understanding</td></tr>
<tr><td colspan="2">4 marks
complete and correct, reflecting exceptional understanding
4 criteria correct</td></tr>
</table>

Marking Key
1 mark for identifying common characteristics (both increasing, both maximum) in a)
1 mark for reasonable explanation in a)
1 mark for correct period for Mr. Jones in b)
1 mark for reasonable comparison in b)

Student exemplar 1

Total:
4 marks

Two business partners, Mr. Smith and Mr. Jones, have consulted biorhythm graphs to determine the ideal and most appropriate time to conduct the grand opening of their new store. Their personalized biorhythm graphs show how their energy levels fluctuate during the day and correspond to the equations below:

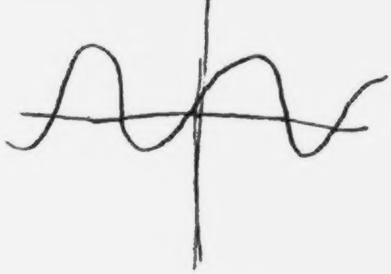
Mr. Smith: $E = 1.3 \sin(1.3t) + 0.5$
Mr. Jones: $E = 1.3 \sin(1.87t) + 0.5$

Time in hours is measured on the horizontal axis, and energy level is measured on the vertical axis.

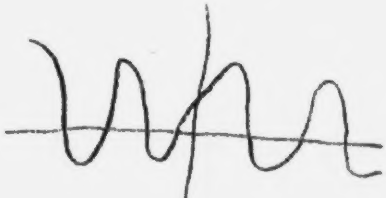
a) If $t = 0$ at midnight, at what time of day should they hold their grand opening? Use their biorhythm graphs to explain why.

(2 marks)

$y = 1.3\sin(1.3x) + 0.5$



$y = 1.3\sin(1.87x) + 0.5$



Max
$x = 69.2$ $y = 1.8$

max
$x = 48.12$ $y = 1.8$

Hold grand opening at approx. 2:20 pm

b) Identify the period of the equation of Mr. Jones's biorhythm. Explain what this period means by comparing it with Mr. Smith's biorhythm.

(2 marks)

Period $= \frac{2\pi}{1.3} = 4.83$ for Mr. Jones

Mr. Smith's is $\frac{2\pi}{1.87} = 3.36$

1 mark:
- 0 marks for a)
- 1 mark for period in b)
- 0 marks for explanation in b)

Student exemplar 2

Total:
4 marks

Two business partners, Mr. Smith and Mr. Jones, have consulted biorhythm graphs to determine the ideal and most appropriate time to conduct the grand opening of their new store. Their personalized biorhythm graphs show how their energy levels fluctuate during the day and correspond to the equations below:

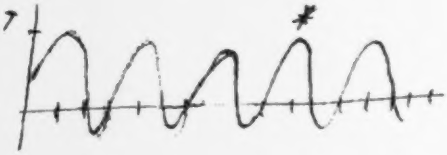
Mr. Smith: $E = 1.3\sin(1.3t) + 0.5$
Mr. Jones: $E = 1.3\sin(1.87t) + 0.5$

Time in hours is measured on the horizontal axis, and energy level is measured on the vertical axis.

a) If $t = 0$ at midnight, at what time of day should they hold their grand opening? Use their biorhythm graphs to explain why.

(2 marks)

Mr. S = 10.91
Mr. J = 10.91



h m s
at 10:54:36 am both are at thier energy peaks so they should host thier grand opening around them.

b) Identify the period of the equation of Mr. Jones's biorhythm. Explain what this period means by comparing it with Mr. Smith's biorhythm.

(2 marks)

Mr J = 3.3
Mr S = 5

The periode of Mr Jones biorhythm is aprox 3.3 wich differs from mr smith by aprox 0.5 meaning that they will only intersect on various high points and are not the same.

3 marks:

- 2 marks for a)
- 1 mark for period in b)
- 0 marks for explanation in b)

Student exemplar 3

Total: 4 marks

Two business partners, Mr. Smith and Mr. Jones, have consulted biorhythm graphs to determine the ideal and most appropriate time to conduct the grand opening of their new store. Their personalized biorhythm graphs show how their energy levels fluctuate during the day and correspond to the equations below:

Mr. Smith: $E = 1.3 \sin(1.3t) + 0.5$
Mr. Jones: $E = 1.3 \sin(1.87t) + 0.5$

Time in hours is measured on the horizontal axis, and energy level is measured on the vertical axis.

a) If $t = 0$ at midnight, at what time of day should they hold their grand opening? Use their biorhythm graphs to explain why.

(2 marks)

At 11:00. That is the time where their biorhythms intersect at the highest point

b) Identify the period of the equation of Mr. Jones's biorhythm. Explain what this period means by comparing it with Mr. Smith's biorhythm.

(2 marks)

1.87 this means that Mr. Jones Biorhythm changes more gradually than mr. Smiths, because Mr. Smiths biorhythm is 1.3.

1 mark:

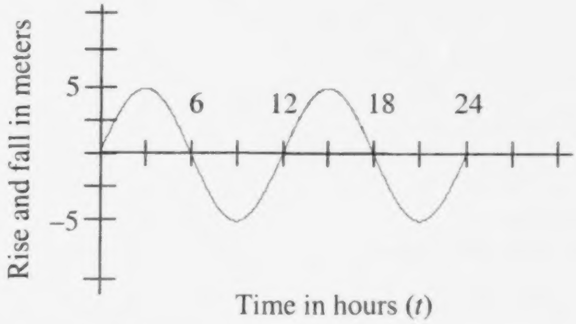
- 1 mark for a) (reasonnable explanation)
- 0 marks for b)
- 0 marks for explanation in b)

Specific Outcomes: G1, G3 **Item Type: Restricted Response**

Question No. 22 and Answer

The ocean tides rise and fall periodically as shown in the graph below.

Total:
3 marks



a) **Determine the equation of the graph.**

(2 marks)

$a = 5 \quad d = 0 \quad c = 0$
period = 12

$$b = \frac{6.28}{12} = 0.523$$

$y = 5 \sin (0.523t)$
or
$y = 5 \cos (0.523 (t - 3))$

b) **To the nearest tenth of an hour, after how many hours does the tide first reach 4 metres?**

(1 mark)

Sketch $y = 4$ and find the first point of intersection

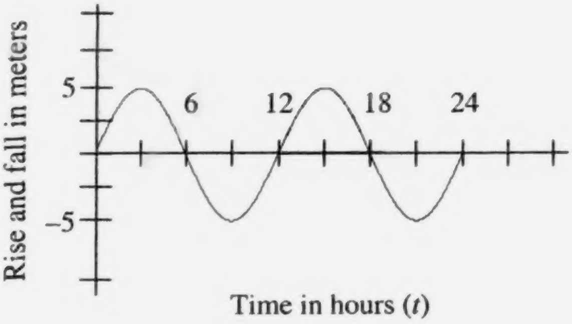
$t = 1.8$ when $x = 4$

Marking Key
2 marks for correct equation in a) (1/2 mark for each parameter) *1 mark for correct time in b)*

Student exemplar 1

The ocean tides rise and fall periodically as shown in the graph below.

Total:
3 marks



a) Determine the equation of the graph.

(2 marks)

Max 5
min -5
Median 0

Period = $\frac{\pi}{6}$
Phase shft = 0
vertial shift = 0

$y = 5\sin\left(\frac{\pi}{6}X\right)$

b) To the nearest tenth of an hour, after how many hours does the tide first reach 4 metres?

(1 mark)

1.77 hours

or

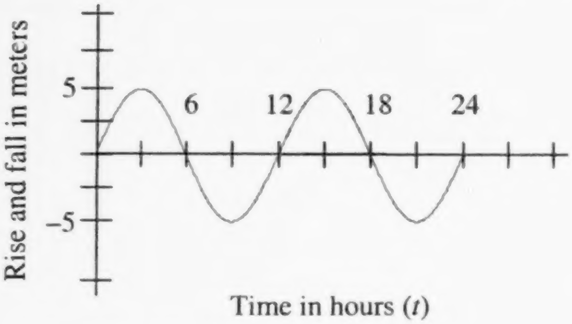
1:47

3 marks:
- 3 marks correct and complete

Student exemplar 2

The ocean tides rise and fall periodically as shown in the graph below.

Total:
3 marks



a) Determine the equation of the graph.

(2 marks)

$y = 5\sin(2\pi/2)x$

b) To the nearest tenth of an hour, after how many hours does the tide first reach 4 metres?

(1 mark)

I'd say it reachs 4 meters
in the 2nd hour.

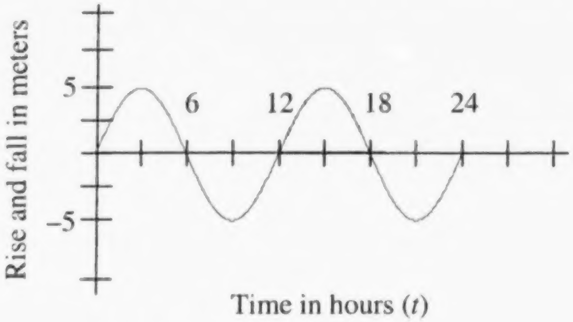
The first black line indicates the 3rd hour,
second is the sixth.
∴ the 4th meter falls
right underneath the second.
HOUR

1 ½ marks:
- 1 ½ marks for correct *a* value in a)
- 0 marks for b)

Student exemplar 3

The ocean tides rise and fall periodically as shown in the graph below.

Total:
3 marks



a) Determine the equation of the graph.

(2 marks)

$5\sin(.52x)$

b) To the nearest tenth of an hour, after how many hours does the tide first reach 4 metres?

(1 mark)

1.5

1:30 The tide will reach 4m.

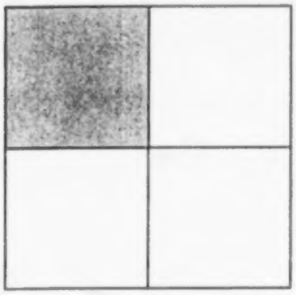
2 marks:

- 2 marks for equation in a)
- 0 marks for explanation in b)

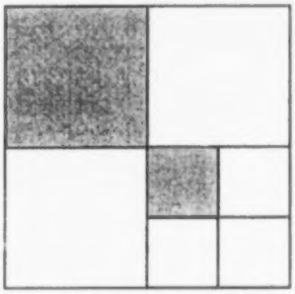
Question No. 23 and Answer

Two generations of a fractal pattern are shown in the diagram below.

Total:
4 marks



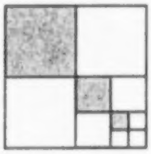
Generation 1



Generation 2

a) **Write instructions for creating the next generation of the fractal.**

(2 marks)



Generation 3

Divide the lowest right hand square into 4 equal quadrants.
Shade the upper left quadrant of the newly divided square.

b) **If the side length of the original shaded square is 4 cm, what would the sum of all shaded areas be in generation 4? Show all work.**

(2 marks)

Generation	Area	Sum of Areas
1	16	16
2	4	20
3	1	21
4	0.25	21.25

Question No. 23 continued

Scoring Rubric

General Performance Indicators	
Level 1 - limited understanding	
1 mark **weak attempt, inappropriate strategy or no strategy** 1 criterion correct	
Level 2 - good understanding	
2 marks **reasonable attempt, appropriate strategy, minor errors and/or omissions** 2 criteria correct	**3 marks** **complete and correct with minor errors** 3 criteria correct
Level 3 - exceptional understanding	
4 marks **complete and correct, reflecting exceptional understanding** 4 criteria correct	

Marker Notes:

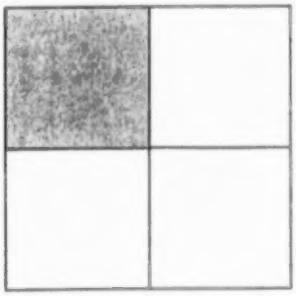
- *No diagrams are required in the response.*

Marking Key
1 mark for instruction for dividing the square in a)
1 mark for instruction for shading in a)
1 mark for work shown indicating an appropriate strategy in b)
1 mark for correct sum in b)

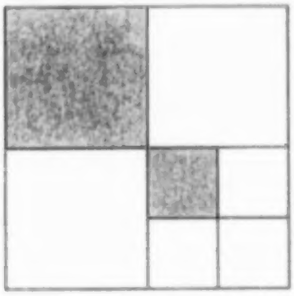
Student exemplar 1

Two generations of a fractal pattern are shown in the diagram below.

Total:
4 marks



Generation 1



Generation 2

a) Write instructions for creating the next generation of the fractal.

(2 marks)

The very corner right bottom square divide into 4 equal squares, and then shade the upper left corner square.

b) If the side length of the original shaded square is 4 cm, what would the **sum** of **all** shaded areas be in generation 4? Show all work.

(2 marks)

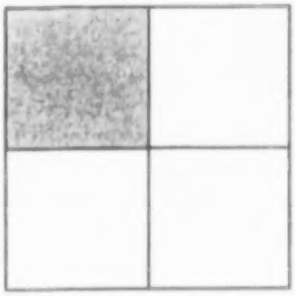
$4 + 2 + 1 + .5 = 7.5$ cm

2 marks:
- 1 mark for explaining division of square
- 1 mark for explaining shading of square
- 0 marks for strategy in b)

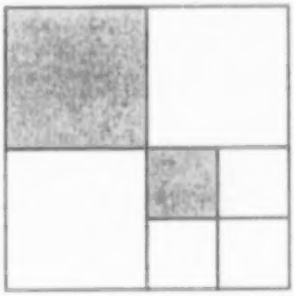
Student exemplar 2

Two generations of a fractal pattern are shown in the diagram below.

Total:
4 marks



Generation 1



Generation 2

a) Write instructions for creating the next generation of the fractal.

(2 marks)

Break the square (attaching to the bottom right corner of the last) into 4 equal parts and shade the attached corner.

b) If the side length of the original shaded square is 4 cm, what would the **sum** of **all** shaded areas be in generation 4? Show all work.

(2 marks)

$$(4\times4)+(2\times2)+(1\times1)+(.5\times.5)=$$

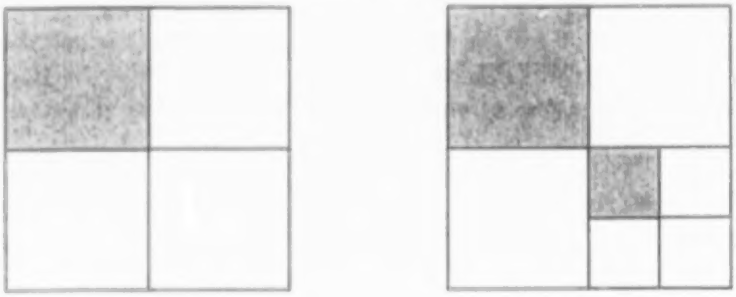
$$22.25\text{cm}^2$$

3 marks:
- 1 mark for shading in a)
- 1 mark for division in a)
- 1 mark for strategy in b)
- 0 marks for answer in b)

Student exemplar 3

Two generations of a fractal pattern are shown in the diagram below.

Total:
4 marks



Generation 1 Generation 2

a) Write instructions for creating the next generation of the fractal.

(2 marks)

Divide the bottom right hand corner square into four equal squares, then shade in the top left hand corner square.

b) If the side length of the original shaded square is 4 cm, what would the **sum** of **all** shaded areas be in generation 4? Show all work.

(2 marks)

Square	Area
1	16
2	4 + 16
3	1 + 4 + 16
4	0.25 + 1 + 4 + 16 = 21.25 cm

$4 \times 4 = 16$

$2 \times 2 = 4$

$1 \times 1 = 1$

$0.5 \times 0.5 = 0.25$

sum of all shaded area = $\boxed{21.25\text{ cm}^2}$

4 marks:

- 4 marks correct and complete

Specific Outcomes: H1 **Item Type: Restricted Response with Explanation**

Question No. 24 and Answer

Total:
4 marks

You would like to sell your car by advertising in a local newspaper. The advertisement costs $32.00 for the first day. If your car does not sell the first day, the newspaper applies a daily 5% discount, and a daily $3.00 reduction in the cost of the advertisement. The reductions apply on the second day and continue until your car is sold or until the cost of the advertisement is $0.

a) Determine the cost of the advertisement on day 5, if the car does not sell. Show your work and state your assumptions.

(2 marks)

Solution 1: using sequence mode on TI-83

nMin = 1
u(n) = u(n – 1) * 0.95 – 3
u(nMin) = 32
Day 5: $14.94

OR

Solution 2: using sequence mode on TI-83

nMin = 1
u(n) = (u(n – 1) – 3)* 0.95
u(nMin) = 32
Day 5: $15.49

b) Which day does the price of the advertisement become $0?

(1 mark)

On day 10, the price goes to zero.

On day 10, the price goes to zero.

c) Assuming that the car does not sell for several weeks, what is the maximum total amount you would pay for advertising in this newspaper?

(1 mark)

$140.33

$145.15

Day	Price of advertisement
1	$32.00
2	$27.40
3	$23.03
4	$18.88
a) 5	**$14.93**
6	$11.19
7	$7.63
8	$4.25
9	$1.03
b) 10	**0**
c)	**Total sum $140.34**

Day	Price of advertisement
1	$32.00
2	$27.55
3	$23.32
4	$19.31
a) 5	**$15.49**
6	$11.87
7	$8.42
8	$5.15
9	$2.04
b) 10	**0**
c)	**Total sum $145.15**

Question No. 24 continued

Marking Key
1 mark for work shown indicating an appropriate strategy in a)
1 mark for correct answer in a)
1 mark for correct answer in b)
1 mark for correct answer in c)

Student exemplar 1

Total:
4 marks

You would like to sell your car by advertising in a local newspaper. The advertisement costs $32.00 for the first day. If your car does not sell the first day, the newspaper applies a daily 5% discount, and a daily $3.00 reduction in the cost of the advertisement. The reductions apply on the second day and continue until your car is sold or until the cost of the advertisement is $0.

a) Determine the cost of the advertisement on day 5, if the car does not sell. Show your work and state your assumptions.

(2 marks)

$1^{st} = \$32$

$2^{st} = 32 \cdot .05 = 30.4 - 3 = 27.4$

$3^{rd}\ 27.4 \cdot .05 = 27.4 - 1.37 - 3 = 23.03$

$4^{th}\ 23.03 \cdot .05 = 23.03 - 1.15 - 3 = 18.88$

$5^{th}\ 18.88 \cdot .05 = 18.88 - .94 - 3 = \underline{14.94}$

$32 + 27.4 + 23.03 + 18.88 + 14.94$
$= 116.25$

b) Which day does the price of the advertisement become $0?

(1 mark)

$6^{th}\ 14.94 \cdot .05 = 14.94 - .75 - 3 = 11.19$

$7^{th}\ 11.19 \cdot .05 = 11.19 - .56 - 3 = 7.63$

$8^{th}\ 7.63 \cdot .05 = 7.63 - .38 - 3 = 4.25$

$9^{th}\ 4.25 \cdot .05 = 4.25 - .21 - 3 = 1.04$

$10^{t0}\ 1.04 \cdot .05 = 1.04 - .5 - 3 = 0$

$\boxed{10^{th}\text{ day}}$

c) Assuming that the car does not sell for several weeks, what is the maximum total amount you would pay for advertising in this newspaper?

(1 mark)

$116.25 + 11.19 + 7.63 + 4.25 + 1.04$

$\boxed{\$140.36}$

4 marks:
- 2 marks for strategy and answer in a)
- 2 marks for answer in b) and c)

Student exemplar 2

Total:
4 marks

You would like to sell your car by advertising in a local newspaper. The advertisement costs $32.00 for the first day. If your car does not sell the first day, the newspaper applies a daily 5% discount, and a daily $3.00 reduction in the cost of the advertisement. The reductions apply on the second day and continue until your car is sold or until the cost of the advertisement is $0.

a) Determine the cost of the advertisement on day 5, if the car does not sell. Show your work and state your assumptions.

(2 marks)

The cost on Day would be $14,93

b) Which day does the price of the advertisement become $0?

(1 mark)

The advertisment becomes 0 on Day 10

c) Assuming that the car does not sell for several weeks, what is the maximum total amount you would pay for advertising in this newspaper?

(1 mark)

The maximum you could pay is $140.34

3 marks:
- 1 mark for correct answer in a)
- 1 mark for correct answer in b)
- 1 mark for correct answer in c)

Student exemplar 3

Total:
4 marks

You would like to sell your car by advertising in a local newspaper. The advertisement costs $32.00 for the first day. If your car does not sell the first day, the newspaper applies a daily 5% discount, and a daily $3.00 reduction in the cost of the advertisement. The reductions apply on the second day and continue until your car is sold or until the cost of the advertisement is $0.

a) Determine the cost of the advertisement on day 5, if the car does not sell. Show your work and state your assumptions.

(2 marks)

$= u(n-1) \times .95 - 3$

$= u(\text{min}) = \{32\}$

$= \$11,19$

b) Which day does the price of the advertisement become $0?

(1 mark)

Between day 8 and nine before they start owing me money.

c) Assuming that the car does not sell for several weeks, what is the maximum total amount you would pay for advertising in this newspaper?

(1 mark)

$\$32.^{00}$

1 mark:

- 1 mark for strategy in a)
- 0 marks for answer in a), b), and c)

Marking Keys and Scoring Rubrics for the Inquiry Task

BLANK PAGE

Specific Outcomes: C1, C3, C4 **Item Type: Open Response**

Inquiry Task Question No. 1 and Answer

PERSONAL FINANCE

Total: 10 marks

Sally plans to purchase a vehicle for \$24 549.90 including PST and GST. Sally has also been given a gift of \$3000.00 from her grandparents. She must decide on one of two options for purchasing the vehicle.

(1 mark) **One mark will be awarded for clearly showing your work or strategy and all calculated results.**

Option 1

Sally can pay for the car by taking out a loan for the entire amount at a rate of 8.75% compounded monthly for 5 years. She can invest the \$3000.00 for 5 years at 6% compounded semi-annually.

a) What will Sally's monthly loan payment be?

(1 mark)

N = 60	N = 60
I% = 8.75	I% = 8.75
PV = \$24 549.90	PV = \$24 549.90
***PMT = \$–506.64**	***PMT = \$502.97**
FV = 0	FV = 0
P/Y = 12	P/Y = 12
C/Y = 12	C/Y = 12
PMT = [✓ END] BEGIN	PMT = END [✓ BEGIN]

b) How much will Sally's investment be worth in 5 years?

(1 mark)

N = 60	N = 60
I% = 6	I% = 6
PV = –3000.00	PV = –3000.00
PMT = 0	PMT = 0
***FV = \$4031.75**	***FV = \$4031.75**
P/Y = 12	P/Y = 12
C/Y = 2	C/Y = 2
PMT = [✓ END] BEGIN	PMT = END [✓ BEGIN]

Inquiry Task Question No. 1 continued

OR

If done yearly

N = 10
I% = 6
PV = –3000.00
PMT = 0
***FV = $4031.75**
P/Y = 2
C/Y = 2
PMT = [✓ END] BEGIN

Option 2

Sally uses her $3000.00 gift as a down payment on her car. She finances the remaining amount with a loan at a rate of 8.75% compounded monthly for 5 years.

c) What will Sally's new monthly loan payment be?

(1 mark)

(21 535.00 × 1.14) – 3000.00 = $21 549.90

N = 60
I% = 8.75
PV = 21 549.90
***PMT = –444.73**
FV = 0
P/Y = 12
C/Y = 12
PMT = [✓ END] BEGIN

N = 60
I% = 8.75
PV = 21 549.90
***PMT = –441.51**
FV = 0
P/Y = 12
C/Y = 12
PMT = END [✓ BEGIN]

Inquiry Task Question No. 1 continued

d) **Sally decides to invest the difference between the loan payment of Option 1 and the loan payment of Option 2 for 5 years. She deposits this amount each month into her savings account, which pays 1.5% annual interest compounded monthly. How much will Sally's investment be worth in 5 years?**

(2 marks)

506.64 – 444.73 = 61.91	502.97 – 441.51 = 61.46
N = 60	N = 60
I% = 1.5	I% = 1.5
PV = 0	PV = 0
PMT = 61.91	PMT = 61.46
***FV = $3854.95**	***FV = $3826.93**
P/Y = 12	P/Y = 12
C/Y = 12	C/Y = 12
PMT = [✓ END] BEGIN	PMT = [✓ END] BEGIN
***FV = $3859.76**	***FV = $3831.71**
PMT = END [✓ BEGIN]	PMT = END [✓ BEGIN]

Another option for d)

Sally Option 1
a) $506.64
b) $4031.75
c) $444.73
d) difference $61.91
investment is worth $3854.95

Sally Option 1
a) =PMT(0.0875/12,60,-24549.9,0)
b) =FV(0.06/2,10,0,-3000)
c) =PMT(0.0875/12,60,(-24549.9+3000),0)
d) difference =B3-B5
investment is worth =FV(0.015/12,60,-61.91)

Inquiry Task Question No. 1 continued

e) **Provide an analysis to compare the total costs and benefits for each option. State one advantage for choosing each option.**

(4 marks)

Option 1	**Option 2**
Loan payment: $506.64	Loan payment: $444.73
Interest paid: So, 506.64 × 60 = $30 398.40 − 24 549.90 = 5848.50	Interest paid: 444.73 × 60 = $26 683.80 − 24 549.90 = 2133.90
Investment: $4031.75 Net Return: So, 4031.75 − 3000.00 = 1031.75	Investment: $3854.95 Net Return: $3854.95 − 3714.60 = 140.35
Advantage: - Make more money on your investment - Have money which is accessible	Advantage: - Lower monthly loan payments - Lower overall loan cost (by $2823.20)

Inquiry Task Question No. 1 continued

Scoring Rubric

<table>
<tr><th colspan="12">General Performance Indicators</th></tr>
<tr><th colspan="12">Level 1 – limited understanding</th></tr>
<tr>
<td colspan="4">1 mark
weak attempt, inappropriate strategy or no strategy
any combination of criteria for 1 mark</td>
<td colspan="4">2 marks
reasonable attempt, inappropriate strategy, major errors or omissions
any combination of criteria for 2 marks</td>
<td colspan="4">3 marks
reasonable attempt, inappropriate strategy but carried through correctly
any combination of criteria for 3 marks</td>
</tr>
<tr><th colspan="12">Level 2 - good understanding</th></tr>
<tr>
<td colspan="3">4 marks
sound strategy with major errors
any combination of criteria for 4 marks</td>
<td colspan="3">5 marks
sound strategy with minor errors
any combination of criteria for 5 marks</td>
<td colspan="3">6 marks
mostly complete with some omissions
any combination of criteria for 6 marks</td>
<td colspan="3">7 marks
close to complete and correct, major errors
any combination of criteria for 7 marks</td>
</tr>
<tr><th colspan="12">Level 3 – exceptional understanding</th></tr>
<tr>
<td colspan="4">8 marks
close to complete and correct, minor errors
any combination of criteria for 8 marks</td>
<td colspan="4">9 marks
almost complete and correct, trivial errors
any combination of criteria for 9 marks</td>
<td colspan="4">10 marks
complete and correct, reflecting exceptional understanding
any combination of criteria for 10 marks</td>
</tr>
</table>

Marker Notes:

- *Website answers are also acceptable.*

Marking Key
1 mark for work shown indicating an appropriate strategy
1 mark for correct payment based on loan amount in a)
1 mark for final investment value in b)
1 mark for correct payment based on loan amount in c)
1 mark for correct difference (payment amount) in d)
1 mark for final investment value in d)
1 mark for analysis of Option 1 in e) consistent with a, b, c, and d
1 mark for analysis of Option 2 in e) consistent with a, b, c, and d
1 mark for reason for Option 1 in e)
1 mark for reason for Option 2 in e)

Student exemplar 1

PERSONAL FINANCE

Total:
10 marks

Sally plans to purchase a vehicle for $24 549.90 including PST and GST. Sally has also been given a gift of $3000.00 from her grandparents. She must decide on one of two options for purchasing the vehicle.

(1 mark) **One mark will be awarded for clearly showing your work or strategy and all calculated results.**

Option 1

Sally can pay for the car by taking out a loan for the entire amount at a rate of 8.75% compounded monthly for 5 years. She can invest the $3000.00 for 5 years at 6% compounded semi-annually.

a) What will Sally's monthly loan payment be?

(1 mark)

Sally's monthly
loan payment
will be $444.97

$24549.90
× 1.0875
$26698.16
60 (months)
$444.97

b) How much will Sally's investment be worth in 5 years?

(1 mark)

N = 10
I = 6
PV = 3000
PMT = 0
FV = $4031.75
P/Y = 2
C/Y = 2

Sally's
investment will
be worth
$4031.75
in 5 years.

Student exemplar 1 continued

Option 2
Sally uses her $3000.00 gift as a down payment on her car. She finances the remaining amount with a loan at a rate of 8.75% compounded monthly for 5 years.

c) What will Sally's new monthly loan payment be?

(1 mark)

Sally's new
monthly payment
is $390.59.

24549.90
− 3000
$21549.90
× 1.0875
$23435.52
÷ 60
$390.59

d) Sally decides to invest the difference between the loan payment of Option 1 and the loan payment of Option 2 for 5 years. She deposits this amount each month into her savings account, which pays 1.5% annual interest compounded monthly. How much will Sally's investment be worth in 5 years?

(2 marks)

444.97 - 390.59
= 54.38

$54.38 × 60
= $3262.80

$3262.80 × 1.015
= $3311.74

Sally's investment will be wort
$3311.74 after 5 years.

Student exemplar 1 continued

e) Provide an analysis to compare the total costs and benefits for each option. State one advantage for choosing each option.

(4 marks)

Sally should go with option 2. If she uses her $3000 gift as a down payment on the car, She can pay a smaller monthly loan payment. The money saved would be put into her savings account, which she could use for other things. However, she would have a larger investment at the end, if she chooses option 1. If she decides on option 1, her Monthly loan payment will be higher.

5 marks:
- 1 mark for correct answer in b)
- 1 mark for strategy
- 1 mark for correct difference in d)
- 2 marks for 2 valid reasons in e)

Student exemplar 2

PERSONAL FINANCE

Total: 10 marks

Sally plans to purchase a vehicle for \$24 549.90 including PST and GST. Sally has also been given a gift of \$3000.00 from her grandparents. She must decide on one of two options for purchasing the vehicle.

(1 mark) **One mark will be awarded for clearly showing your work or strategy and all calculated results.**

Option 1

Sally can pay for the car by taking out a loan for the entire amount at a rate of 8.75% compounded monthly for 5 years. She can invest the \$3000.00 for 5 years at 6% compounded semi-annually.

(1 mark) a) What will Sally's monthly loan payment be?

24 549.90 • 1.0875 /5/12 = \$ 444.97

(1 mark) b) How much will Sally's investment be worth in 5 years?

nMin = 1

u(n) = u(n-1) • 1.06

u(nMin) = {3000}

5yrs/semiannually = \$ 4548.60

Student exemplar 2 continued

Option 2
Sally uses her $3000.00 gift as a down payment on her car. She finances the remaining amount with a loan at a rate of 8.75% compounded monthly for 5 years.

c) What will Sally's new monthly loan payment be?

(1 mark)

$21549.90 \cdot 1.0875/5/12 = \$390.59$

d) Sally decides to invest the difference between the loan payment of Option 1 and the loan payment of Option 2 for 5 years. She deposits this amount each month into her savings account, which pays 1.5% annual interest compounded monthly. How much will Sally's investment be worth in 5 years?

(2 marks)

Difference $= 444.97 - 390.59 = 54.38$

$54.38 * 12 * 5 = 3262.68 * 1.015$
$= \$\ 3311.62$

Student exemplar 2 continued

e) Provide an analysis to compare the total costs and benefits for each option. State one advantage for choosing each option.

(4 marks)

One advantage for option 2 is that the monthly payments are lower.

Total cost option 1:

$444.97 * 5 \times 12 =$ \$26698.20

$-$ 4548.60

\$22149.60

3 marks:

- 1 mark for correct difference in d)
- 1 mark for valid advantage for option 2 in e)
- 1 mark for analysis of option 1 in e)

Student exemplar 3

PERSONAL FINANCE

Total:
10 marks

Sally plans to purchase a vehicle for $24 549.90 including PST and GST. Sally has also been given a gift of $3000.00 from her grandparents. She must decide on one of two options for purchasing the vehicle.

(1 mark) **One mark will be awarded for clearly showing your work or strategy and all calculated results.**

Option 1

Sally can pay for the car by taking out a loan for the entire amount at a rate of 8.75% compounded monthly for 5 years. She can invest the $3000.00 for 5 years at 6% compounded semi-annually.

a) What will Sally's monthly loan payment be?

(1 mark)

Price of car = (21535)(1.14) = $24,549.90

TVM SOLVER

N = 60
I% = 8.75
PV = 24549.90
PMT = ALPHA SOLVE = -506.64
FV = 0
P/Y = 12
C/Y = 12

HER MONTHLY LOAN PAYMENT IS $506.64

b) How much will Sally's investment be worth in 5 years?

(1 mark)

TVM SOLVER

N = 10
I% = 6
PV = 3000
PMT = 0
FV = ALPHA SOLVE = -4031.75
P/Y = 2
C/Y = 2

HER INVESTMENT WILL BE WORTH $4031.75

Student exemplar 3 continued

Option 2
Sally uses her $3000.00 gift as a down payment on her car. She finances the remaining amount with a loan at a rate of 8.75% compounded monthly for 5 years.

c) What will Sally's new monthly loan payment be?

(1 mark)

PRICE OF CAR - DOWN PAYMENT = (24549.90) - (3000) = $21549.90

TVM SOLVER
N = 60
I% = 8.75
PV = 21549.90
PMT = ALPHA SOLVE = -444.73
FV = 0
P/Y = 12
C/Y = 12

HER NEW MONTHLY LOAN PAYMENTS WILL BE $444.73.

d) Sally decides to invest the difference between the loan payment of Option 1 and the loan payment of Option 2 for 5 years. She deposits this amount each month into her savings account, which pays 1.5% annual interest compounded monthly. How much will Sally's investment be worth in 5 years?

(2 marks)

DIFFERENCE = OPTION 1 — OPTION 2
= (506.64) — (444.73)
= $61.91

TVM SOLVER
N = 60
I% = 1.5
PV = 0
PMT = $6191
FV = ALPHA SOLVE = -3854.95
P/Y 12
C/Y 12

HER INVESTMENT WILL BE WORTH $3854.95

Student exemplar 3 continued

e) Provide an analysis to compare the total costs and benefits for each option. State one advantage for choosing each option.

(4 marks)

OPTION 1

net loss = (car loan) − (investment)

$= (506.64 \times 60) - (4031.75)$

$= \$26366.65$

* Only real benefit is that the $\$3000$ gift grows quite a lot.

OPTION 2

net loss = (car loan) − (investment)

$= (444.73 \times 60) - (3854.95)$

$= \$22\,828.85$

* cheoper car payments are a perk

I would suggest Sally go with option 2, because she is saving almost 4 thousand dollars, and she doesn't end up paying as mich for her car so if she ever decides to sell it she will not be losing as much money there either.

10 marks:
- 10 marks all complete and correct

Specific Outcomes: F1, F2 **Item Type: Restricted Response with Explanation**

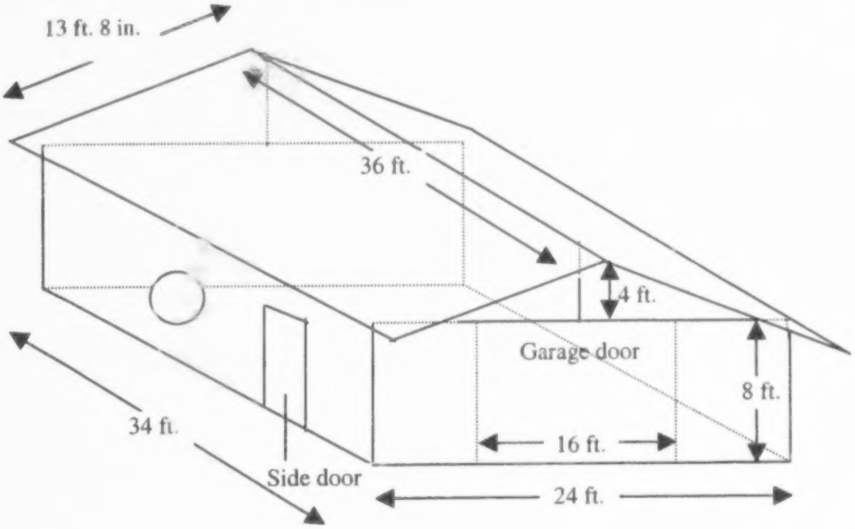
Inquiry Task Question No. 2 and Answer

DESIGN AND MEASUREMENT

A group of high school students has formed a company called Manitoba Stucco and Roofing. A customer has given them a sketch of a garage and has requested a cost estimate for both stucco and aluminum roofing.

Total:
11 marks

- **Clearly organize and show all calculations.**
- **Stucco, aluminum and strapping must be purchased in whole units.**



Stucco

The stucco is to cover all exterior areas except for the following:

- **roof**
- **garage door 16 ft. × 8 ft.**
- **side door 3 ft. × 6 ft. 8 in.**
- **circular window with a 3 ft. diameter**

The cost of applying stucco is $19.95/yd^2.

Inquiry Task Question No. 2 continued

a) **Calculate the area to be covered by stucco.**

(4 marks)

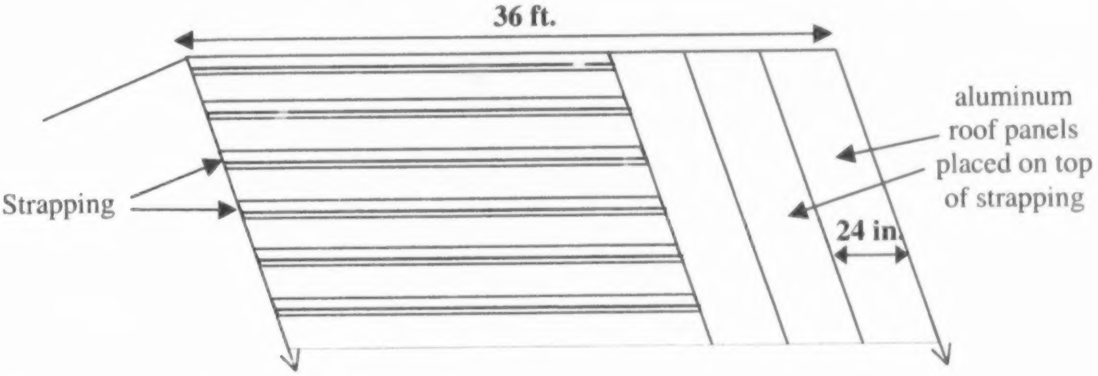
$$\text{Triangular piece: } 4 \times 24 \times 0.5 = 48 \text{ ft.}^2 \times 2 = 96 \text{ ft.}^2$$
$$\text{Front: } 24 \times 8 - 16 \times 8 = 64 \text{ ft.}^2$$
$$\text{Back: } 24 \times 8 = 192 \text{ ft.}^2$$
$$\text{Left side: } 34 \times 8 - 3 \times 6.67 - \pi(1.5)^2 = 244.92 \text{ ft.}^2$$
$$\text{Right side: } 34 \times 8 = 272 \text{ ft.}^2$$
$$\text{Total: } 96 + 64 + 192 + 244.92 + 272 = 868.92 \text{ ft.}^2$$
$$\text{or } \frac{868.92}{9} = 96.54 \text{ yd.}^2$$

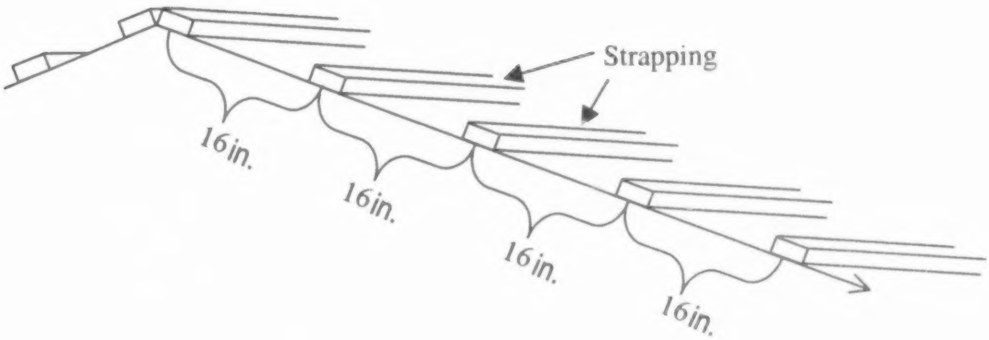
b) **Calculate the total cost of applying stucco, including PST and GST.**

(2 marks)

$$97 \times 19.95 \times 1.14 = \$2206.07$$

Roofing
Before a new metal roof can be attached, 1 in. x 4 in. strapping is nailed to the roof, as shown in the diagrams.


36 ft.
Strapping
aluminum roof panels placed on top of strapping
24 in.


Strapping
16in.
16in.
16in.
16in.

Inquiry Task Question No. 2 continued

- **There are 16 inches from the centre of one piece of strapping to the centre of the next.**
- **The cost of strapping is $0.17 per linear foot.**
- **Aluminum roofing material costs $13.50 per linear foot, in sheets 24 in. wide.**
- **Hardware and finishings cost $100.00, plus taxes.**

c) Calculate the total cost of the new roof. State all assumptions.

(5 marks)

strapping: 13 ft. 8 in. = 164 in.

$\frac{164}{16} = 10.25 \rightarrow$ 11 pieces of strapping per side of roof → 22 pieces of strapping

$22 \times 36 \text{ ft.} \times 0.17 = \$134.64$

aluminum: 36 ft. = 432 in.

$\frac{432}{24} = 18$ pieces of aluminum per side of roof

$36 \times 13\frac{2}{3} \times 13.50 = \$6642.00$ (based on 492') or $6655.50 (based on 493')

Total before tax:	6642.00
	100.00
	+ 134.64
	6876.64
PST	481.36
GST	481.36
Total	**$7839.36**

Total before tax:	6655.50
	100.00
	+ 134.64
	6890.14
PST	482.31
GST	482.31
Total	**$7854.76**

Inquiry Task Question No. 2 continued

Marker Notes:

- *Maximum ½ mark deduction for each kind of technical communication error (not buying in whole units).*

Marking Key
1 mark for area of triangular piece on front and back in a) *1 mark for total area of all walls in a)* *1 mark for subtraction of doors and windows in a)* *1 mark for correct total area in a)* *1 mark for conversion to square yards in b)* *1 mark for total with taxes in b)* *1 mark for amount or length of strapping in c)* *1 mark for amount or length of aluminum in c)* *1 mark for cost of strapping in c)* *1 mark for cost of aluminum in c)* *1 mark for total with taxes and hardware based on assumption in c)*

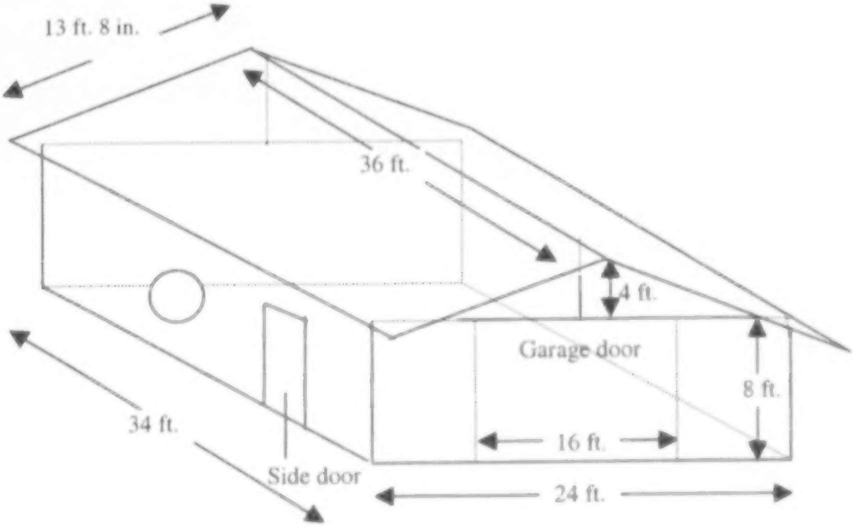
Student exemplar 1

DESIGN AND MEASUREMENT

A group of high school students has formed a company called Manitoba Stucco and Roofing. A customer has given them a sketch of a garage and has requested a cost estimate for both stucco and aluminum roofing.

Total:
11 marks

- **Clearly organize and show all calculations.**
- **Stucco, aluminum and strapping must be purchased in whole units.**



Stucco

The stucco is to cover **all exterior areas** except for the following:

- roof
- garage door 16 ft. × 8 ft.
- side door 3 ft. × 6 ft. 8 in.
- circular window with a 3 ft. diameter

The cost of applying stucco is \$19.95/yd^2.

Student exemplar 1 continued

a) Calculate the area to be covered by stucco.

(4 marks)

Front + Back

$24 \times 8 = 192' \times 2 = 384'^2 / 3 = 128\text{yd}^2$

Sides

$2 \times 34 \times 8 = 544'^2 / 3 = 181.30\text{yd}^2$

total $= 330.67\text{yd}^2$

$- 57.7$

278.97 yd^2

Gables

$4 \times 12 = 24'^2 \times 4 \overset{\times 2}{=} 96'^2 / 3 = 32\text{yd}^2$

The total area to be covered by stucco would be 278.97 yd²

b) Calculate the total cost of applying stucco, including PST and GST.

(2 marks)

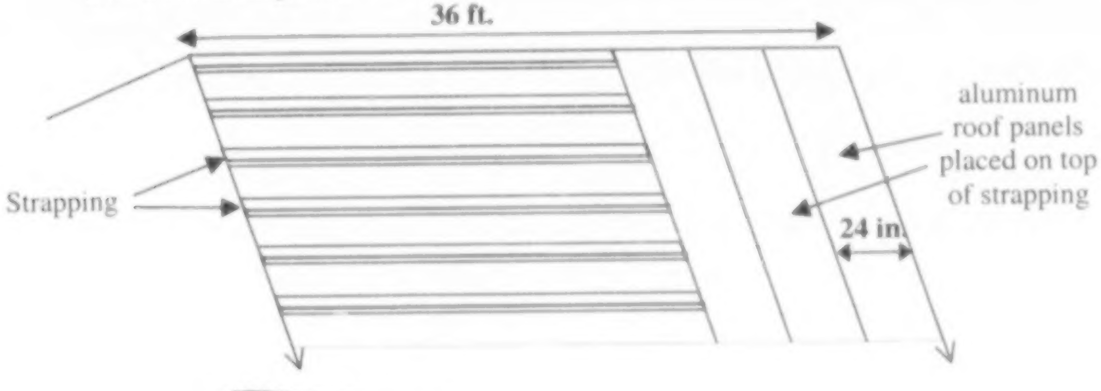
$278.97 \times \$19.95 = \$5565.45 \times 1.14 =$

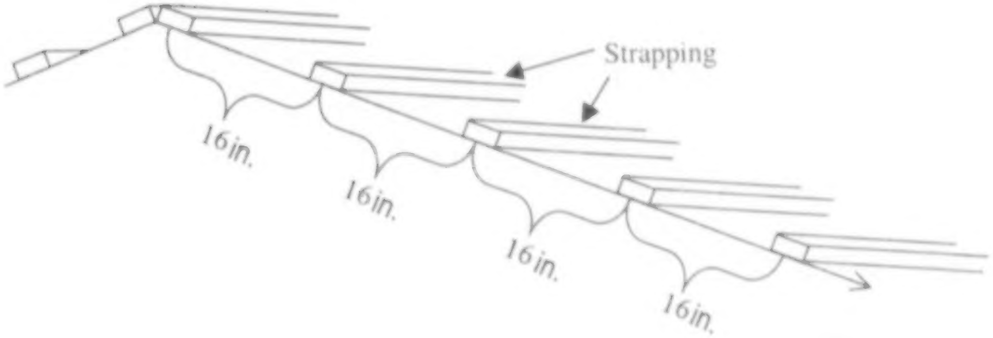
$6344.62

the total cost would be $6344.62

Roofing

Before a new metal roof can be attached, 1 in. x 4 in. strapping is nailed to the roof, as shown in the diagrams.


36 ft.
Strapping
aluminum roof panels placed on top of strapping
24 in.


Strapping
16in.
16in.
16in.
16in.

Student exemplar 1 continued

- There are 16 inches from the centre of one piece of strapping to the centre of the next.
- The cost of strapping is $0.17 per linear foot.
- Aluminum roofing material costs $13.50 per linear foot, in sheets 24 in. wide.
- Hardware and finishings cost $100.00, plus taxes.

c) Calculate the total cost of the new roof. State all assumptions.

(5 marks)

Strapping

13.67/1.33 = 10278. This means 11 rows of strapping is needed for 1 side of the roof

11×36' = 396' ×$0.17 = $67.32

Aluminum Panels

36'/2' = 18 panels needed

13.67'×18 = 246.06' of panels

246.06 ×$13.50 = $3321.81

$3321.81 + $67.32 = 3389.13

×1.14 = $3863.61

the total cost of the roof would be $3863.61

Asumptions:

In part A I assumed that it was unecessary to stuco the roof. In part B I assumed that you did not have to buy an exact linear foot of Aluminum, that you could buy part of a foot. I also assumed that no more than 11 rows of strapping was neccessary for 1 side.

5 ½ marks:

- 1 mark for triangles in a)
- 1 mark for front and back in a)
- 1 mark for sides in a)
- 0 marks for total in a) (addition error)
- 0 marks for conversion in b)
- 1 mark for total in b)
- -1/2 mark for not buying in whole units
- 1 mark for length of strapping in c)
- 1 mark for aluminum lengths in c)
- 0 marks for costs (only ½ roof is done)
- 0 marks for total

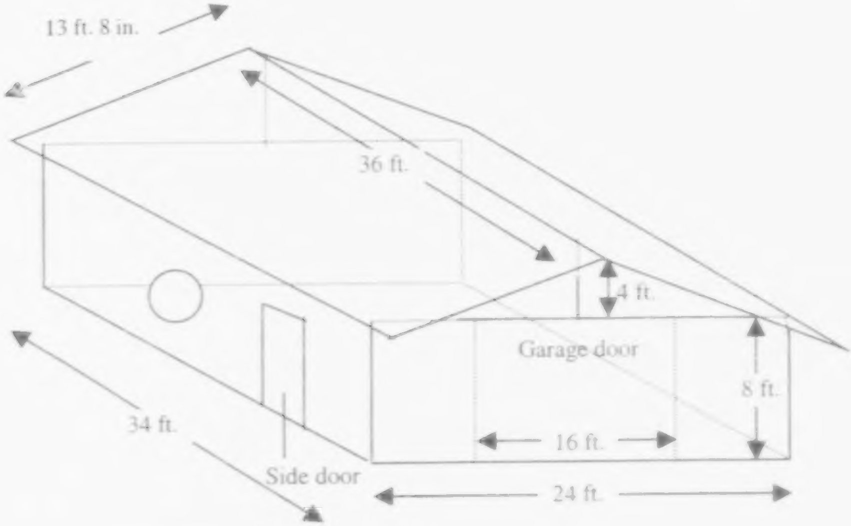
Student exemplar 2

DESIGN AND MEASUREMENT

Total: 11 marks

A group of high school students has formed a company called Manitoba Stucco and Roofing. A customer has given them a sketch of a garage and has requested a cost estimate for both stucco and aluminum roofing.

- **Clearly organize and show all calculations.**
- **Stucco, aluminum and strapping must be purchased in whole units.**



Stucco

The stucco is to cover **all exterior areas** except for the following:

- roof
- garage door 16 ft. × 8 ft.
- side door 3 ft. × 6 ft. 8 in.
- circular window with a 3 ft. diameter

The cost of applying stucco is \$19.95/yd^2.

Student exemplar 2 continued

a) Calculate the area to be covered by stucco.

(4 marks)

Garage sides = $34 \times 8 \times 2 = 544ft^2$

Back = $24 \times 8 = 192ft^2$

Front = $24 \times 8 = 192ft^2$

Δ Top = $24 \times 4 \div 2 \times 2 = 96ft^2$

Total = 1024

Subtract: Door: $16 \times 8 = 128$

Door: $3 \times 6.67 = 20$

Window: $\pi(1.5)^2 = 7.07$

$868.93ft^2$

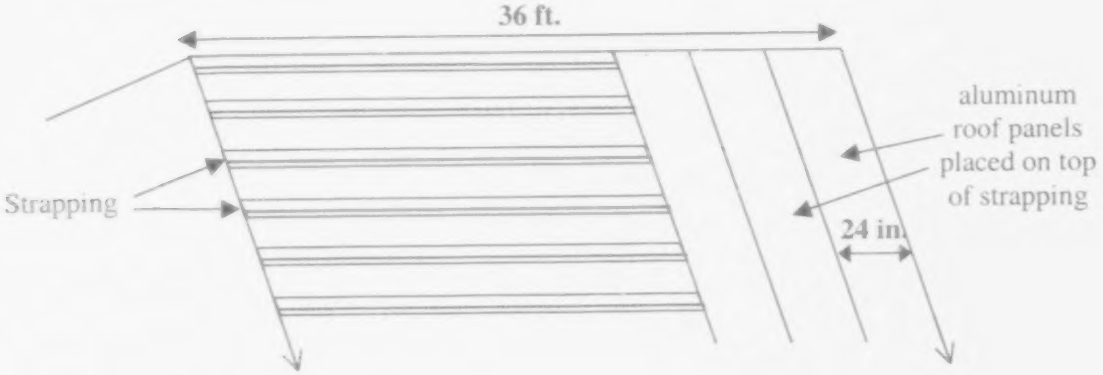
b) Calculate the total cost of applying stucco, including PST and GST.

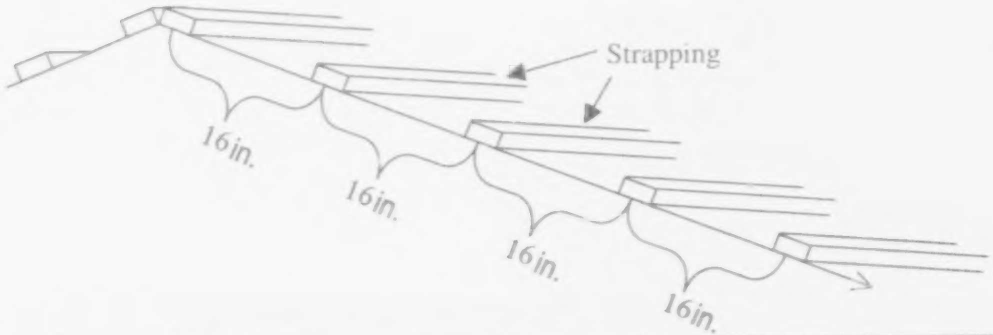
(2 marks)

$868.93 \times 19.95 \times 1.14 = \$19,762.07$

Roofing

Before a new metal roof can be attached, 1 in. x 4 in. strapping is nailed to the roof, as shown in the diagrams.


36 ft.
aluminum roof panels placed on top of strapping
Strapping
24 in.


Strapping
16in.
16in.
16in.
16in.

Student exemplar 2 continued

- There are 16 inches from the centre of one piece of strapping to the centre of the next.
- The cost of strapping is $0.17 per linear foot.
- Aluminum roofing material costs $13.50 per linear foot, in sheets 24 in. wide.
- Hardware and finishings cost $100.00, plus taxes.

(5 marks) c) Calculate the total cost of the new roof. State all assumptions.

36ft × 12 in = 432 in ÷ 16 = 27 straps

27 × 13.67 × .17 = $64.26

Aluminum: 18 sheets × 13.67 × 13.50 = $ 3321.81

Total cost: 64.26 + 3321.81 = 3386.07 × 2 (for each side)

= 6772.14 + 100 (hardware)

= 6872.14

× 1.14

$7834.24

8 ½ marks:

- 4 marks for a) all correct and complete
- 1 mark for total with taxes in b)
- -½ mark for not buying in whole units
- 4 marks in c) (no mark for criteria on strapping amount)

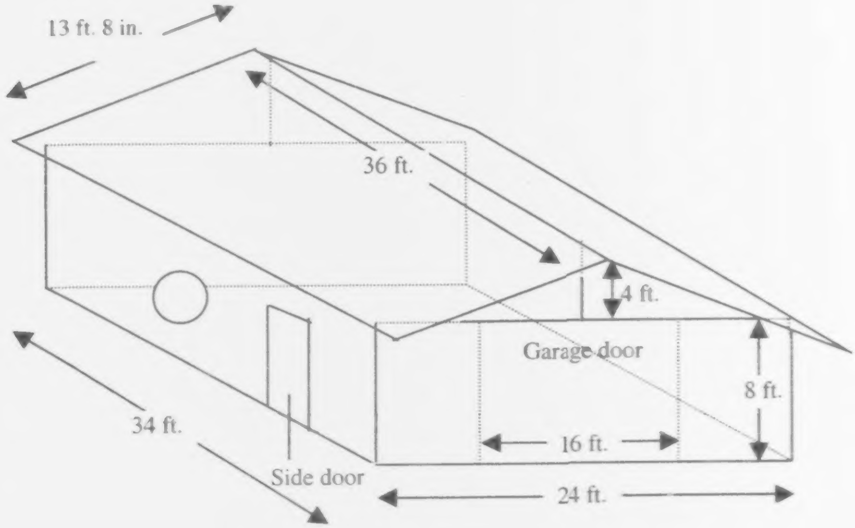
Student exemplar 3

DESIGN AND MEASUREMENT

Total:
11 marks

A group of high school students has formed a company called Manitoba Stucco and Roofing. A customer has given them a sketch of a garage and has requested a cost estimate for both stucco and aluminum roofing.

- **Clearly organize and show all calculations.**
- **Stucco, aluminum and strapping must be purchased in whole units.**



Stucco
The stucco is to cover **all exterior areas** except for the following:

- roof
- garage door 16 ft. × 8 ft.
- side door 3 ft. × 6 ft. 8 in.
- circular window with a 3 ft. diameter

The cost of applying stucco is \$19.95/yd^2.

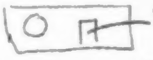
Student exemplar 3 continued

a) Calculate the area to be covered by stucco.

(4 marks)

$a = l \times w$

$8 \times 34 = 272\ ft^2$



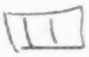
$a = lw$
$= 6.66 \times 3 =$
19.98

$r = \frac{6}{2} = 3/2$

πr^2
$= 7.07\ ft$

$a = l \times w$
$= 34 \times 8 = 272$
$- 7.07 - 19.98$
$= 244.95$

$a = l \times w$
$= 24 \times 8$
$= 192\ ft^2$



$a = l \times w$
$= 16 \times 8$

192
$\underline{128}$
64

$272 + 244.95 + 192 + 64 = 772.95\ ft^2$

b) Calculate the total cost of applying stucco, including PST and GST.

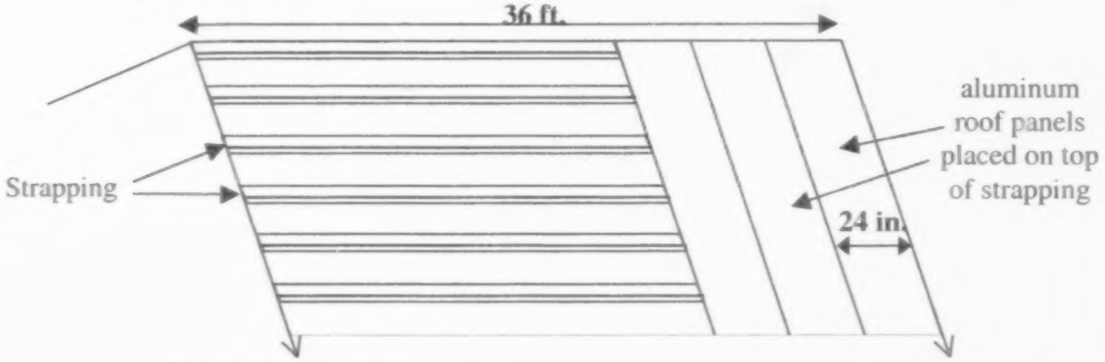
(2 marks)

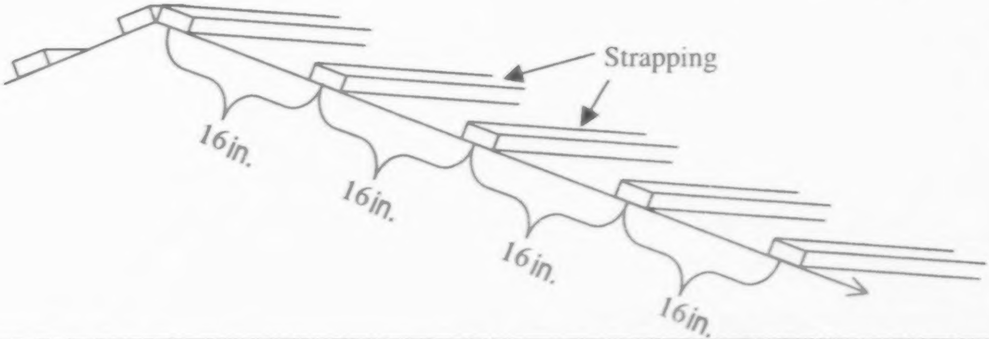
$3\ ft \rightarrow 1\ yd.$
$9\ ft^2 \rightarrow 1\ yd^2$

$\frac{772.95}{9} = 85.883\ yd^2 \times 19.95 \times 1.14 = \$1953.24$

Roofing

Before a new metal roof can be attached, 1 in. x 4 in. strapping is nailed to the roof, as shown in the diagrams.


36 ft.
Strapping
aluminum roof panels placed on top of strapping
24 in.


Strapping
16in.
16in.
16in.
16in.

Student exemplar 3 continued

- There are 16 inches from the centre of one piece of strapping to the centre of the next.
- The cost of strapping is $0.17 per linear foot.
- Aluminum roofing material costs $13.50 per linear foot, in sheets 24 in. wide.
- Hardware and finishings cost $100.00, plus taxes.

c) Calculate the total cost of the new roof. State all assumptions.

(5 marks)

strapping

13×12+8= 164 ÷ 16 = 10.25 so 11 straps

11×36 = 396 × .17 = $67.32

aluminunnim

36×12 ÷ 24 = 18 panels

18×13.50 = 243.×1.14 = $277.02

total = 1953.24 + 67.32 + 277.02 + 100 = 2397.58

×1.14

= $2733.24

6 ½ marks:

- 1 mark for area of front and back in a)
- 1 mark for sides in a)
- 0 marks for triangles in a)
- 1 mark for total in a)
- 1 mark for conversion in b)
- 1 mark total with taxes in b)
- -½ mark for not buying in whole units
- 1 mark for correct length of strapping in c)
- 0 marks for lengths of aluminum in c)
- 0 marks for costs of strapping and aluminum (did only ½ roof in c))
- 1 mark for correct total with taxes in c)

Appendices

APPENDIX A
Table of Specific Outcome Match and Item Type

Multiple-choice items

Question #	Key	Unit	Specific Outcome	Mark
1	D	A	1	1
2	C	B	2	1
3	D	B	1	1
4	B	D	4	1
5	C	D	1	1
6	B	E	1	1
7	B	E	2	1
8	D	G	1	1
9	A	G	2	1
10	C	H	2	1

Restricted-response items

Question #	Unit	Specific Outcome	Mark
12	A	1, 2	3
13	B	1	2
16	D	2	2
17	D	4, 5	3
22	G	1, 3	3

Restricted-response with explanation items

Question #	Unit	Specific Outcome	Mark
14	B	2, 3	2
15	B	2	4
18	D	3, 4	3
19	E	3	3
24	H	1	4
Inquiry 2	F	1, 2	11

Open-response items

Question #	Unit	Specific Outcome	Mark
11	A	1, 2	6
20	E	2, 3	6
21	G	1, 3	4
23	H	2, 3	4
Inquiry 1	C	1, 3, 4	10

APPENDIX B

Generating Student Profiles

Profile of Test Score by Question Type

Item Type	Test Items	Total	÷ Maximum	× 100	= %
Multiple-choice	1 to 10: ____		10		
Restricted-response	12 ____, 13 ____, 16 ____, 17 ____, 22 ____		13		
Restricted-response with explanation	14 ____, 15 ____, 18 ____, 19 ____, 24 ____, Inquiry 2 ____		27		
Open-response	11 ____, 20 ____, 21 ____, 23 ____, Inquiry 1 ____		30		

Profile of Test Score by Curriculum Unit

Unit	Test Items	Total	÷ Maximum	× 100	= %
Matrices	1 ____, 11 ____, 12 ____		10		
Vectors	2 ____, 3 ____, 13 ____, 14 ____, 15 ____		10		
Personal Finance	Inquiry 1 ____		10		
Probability	4 ____, 5 ____, 16 ____, 17 ____, 18 ____		10		
Variability and Statistics	6 ____, 7 ____, 19 ____, 20 ____		11		
Design and Measurement	Inquiry 2 ____		11		
Periodic Functions	8 ____, 9 ____, 21 ____, 22 ____		9		
Sequences	10 ____, 23 ____, 24 ____		9		

APPENDIX C—Sheets for marking the Inquiry Tasks

Inquiry Task 1: Personal Finance		**Booklet Numbers**				
a)	*1 mark for work shown indicating an appropriate strategy*					
	1 mark for correct payment based on loan amount in a)					
b)	*1 mark for final investment value in b)*					
c)	*1 mark for correct payment based on loan amount in c)*					
d)	*1 mark for correct difference (payment amount) in d)*					
	1 mark for final investment value in d)					
e)	*1 mark for analysis of Option 1 in e) consistent with a, b, c, and d*					
	1 mark for analysis of Option 2 in e) consistent with a, b, c, and d					
	1 mark for reason for Option 1 in e)					
	1 mark for reason for Option 2 in e)					
	Totals					

Inquiry Task 1: Personal Finance		**Booklet Numbers**				
a)	*1 mark for work shown indicating an appropriate strategy*					
	1 mark for correct payment based on loan amount in a)					
b)	*1 mark for final investment value in b)*					
c)	*1 mark for correct payment based on loan amount in c)*					
d)	*1 mark for correct difference (payment amount) in d)*					
	1 mark for final investment value in d)					
e)	*1 mark for analysis of Option 1 in e) consistent with a, b, c, and d*					
	1 mark for analysis of Option 2 in e) consistent with a, b, c, and d					
	1 mark for reason for Option 1 in e)					
	1 mark for reason for Option 2 in e)					
	Totals					

Use check marks (✓) to tally students' marks on the question

Inquiry Task 2: Design and Measurement		**Booklet Numbers**				
a)	*1 mark for area of triangular piece on front and back in a)*					
	1 mark for total area of all walls in a)					
	1 mark for subtraction of doors and windows in a)					
	1 mark for correct total area in a)					
b)	*1 mark for conversion to square yards in b)*					
	1 mark for total with taxes in b)					
c)	*1 mark for amount or length of strapping in c)*					
	1 mark for amount or length of aluminum in c)					
	1 mark for cost of strapping in c)					
	1 mark for cost of aluminum in c)					
	1 mark for total with taxes and hardware based on assumption in c)					
	Totals					

Inquiry Task 2: Design and Measurement		**Booklet Numbers**				
a)	*1 mark for area of triangular piece on front and back in a)*					
	1 mark for total area of all walls in a)					
	1 mark for subtraction of doors and windows in a)					
	1 mark for correct total area in a)					
b)	*1 mark for conversion to square yards in b)*					
	1 mark for total with taxes in b)					
c)	*1 mark for amount or length of strapping in c)*					
	1 mark for amount or length of aluminum in c)					
	1 mark for cost of strapping in c)					
	1 mark for cost of aluminum in c)					
	1 mark for total with taxes and hardware based on assumption in c)					
	Totals					

Note: Maximum ½ mark deduction for each type of technical communication error (not buying in whole units)

Use check marks (✓) to tally students' marks on the question